

**Map 11.1 Salt Lake County**

## **Part XI. Salt Lake County**

At 737 square miles, Salt Lake County is the fifth smallest county in land area (Governor's Office of Planning and Budget). Tooele County borders to the west while Summit County borders to the east. To the north, lie Davis and Morgan Counties with Utah County to the south. The Wasatch and Oquirrh Mountains form the east and west borders of the county respectively. The Great Salt Lake occupies much of the northwest corner of the county. Within Salt Lake County are fifteen incorporated areas (Alta, Bluffdale, Cottonwood Heights, Draper City, Herriman, Holladay, Midvale, Murray, Riverton, Salt Lake City, Sandy City, South Jordan, South Salt Lake, Taylorsville, West Jordan, and West Valley) and sixteen unincorporated areas with substantial populations: (Big Cottonwood, Camp Williams, Canyon Rim, Copperton, East Millcreek, Emigration Canyon, Granite West, Kearns, Magna, Millcreek, Mount Olympus, Parley's Canyon, Sandy Hills, Southwest, White City, and Willow Canyon). Salt Lake County's land ownership is 72.8% Private, 20.4% Federal, 2.3% State, and 4.6% water. The county is ranked second relative to the amount of private and local government ownership in Utah.

A significant portion of Salt Lake County is currently zoned for low-density residential development. Some higher densities are allowed in eastern Salt Lake City, while the southeast and southwest areas of Salt Lake County are zoned for lower housing densities. Industrial land uses are planned for west Salt Lake City, along the I-15 corridor, northern West Valley City, the western portion of North Salt Lake, and the west side of Salt Lake County. Areas primarily for commercial use include concentrations in Salt Lake City's central business district and along primary transportation corridors including I-15, I-215, State Street, 400 South, Highland Drive, 3500 South, 4500 South and 7200 South. Additional commercial land use nodes are dispersed throughout Salt Lake County to serve adjoining residential communities. Many public and private lands will remain undeveloped because of specific environmental constraints, such as steep slopes or prime wetlands. Some areas currently being used for industrial or mining activity may be redeveloped for commercial and residential purposes. Much of this land is currently held by Kennecott Utah Copper Corporation.

Salt Lake County is the backbone of Utah's economy, making up 50% of the job market. The service industry, the largest employment division within the County, supplies 26% of the area's wages. Trade is the second major component followed by government and manufacturing. The largest number of government-related employees in Utah is located in Salt Lake County. Salt Lake is a regional center for finance, health care, and high tech industries as well. Major employers include the University of Utah, State of Utah, Intermountain Healthcare, Granite School District, Jordan School District, Salt Lake County, Wal-Mart, Discover Financial Services Inc., Delta Airlines, United States Postal Service, Salt Lake City School District and Salt Lake City.

Both incorporated communities and the county understand the importance of reducing the risk of natural hazards and have therefore already adopted codes, ordinances, and regulations. Such enforcements include earthquake-building codes and slope failure setback requirements. State and local agencies are joining forces with local communities to understand the risk of living in Wildland-Urban Interface (WUI) zones and the measures that can be taken to lessen the loss of life and property in the event of a wildland fire. Drought has been identified as a problem and most cities have taken the initiative to incorporate discounts or credits for using less water. Severe weather has always be a problem in this region and the response measures taken are kept up to date and include many mitigation measures.

## **Hazard History**

Identifying past hazard events provides a starting point for predicting where future events could potentially occur. The following historical hazard event statistics were consolidated from the Spatial Hazard Events and Losses Database for the United States (SHELDUS) of the Hazards and Vulnerability Research Institute. This database records reported natural hazard events which cause greater than \$50,000 in damages. Monetary figures are in 2005 dollars (Figure 11-2).

Over \$199 million in property losses were incurred during the August 1999 Salt Lake City tornado event. This single event caused more destruction than all other significant hazard events in Salt Lake County history combined. See Figure 11-3 for a visual comparison of historical hazard losses to property with and without the 1999 Salt Lake City tornado.

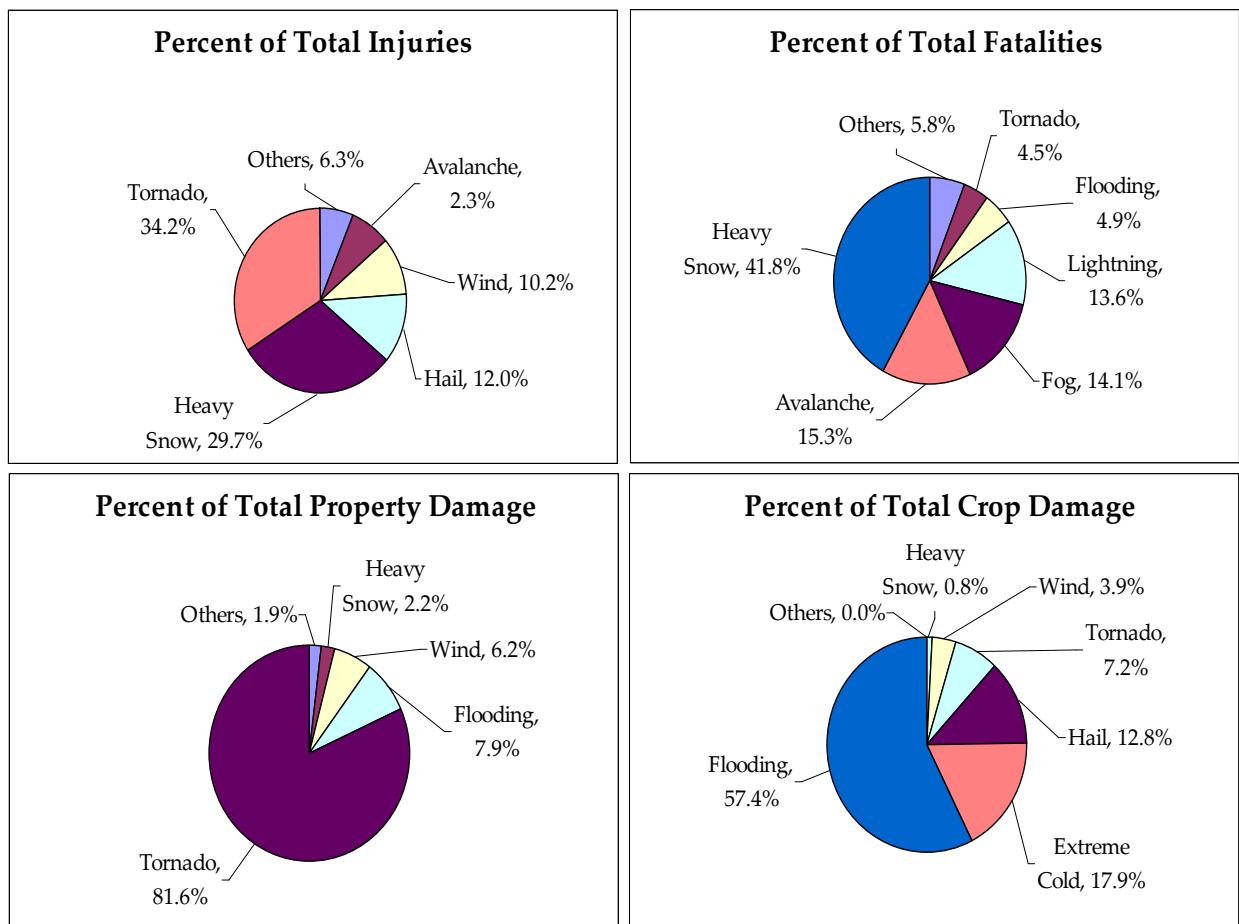


Figure 11-2. Major Disaster Event Averages 1962-2005, Salt Lake County, Percentages (HVRI 2007)

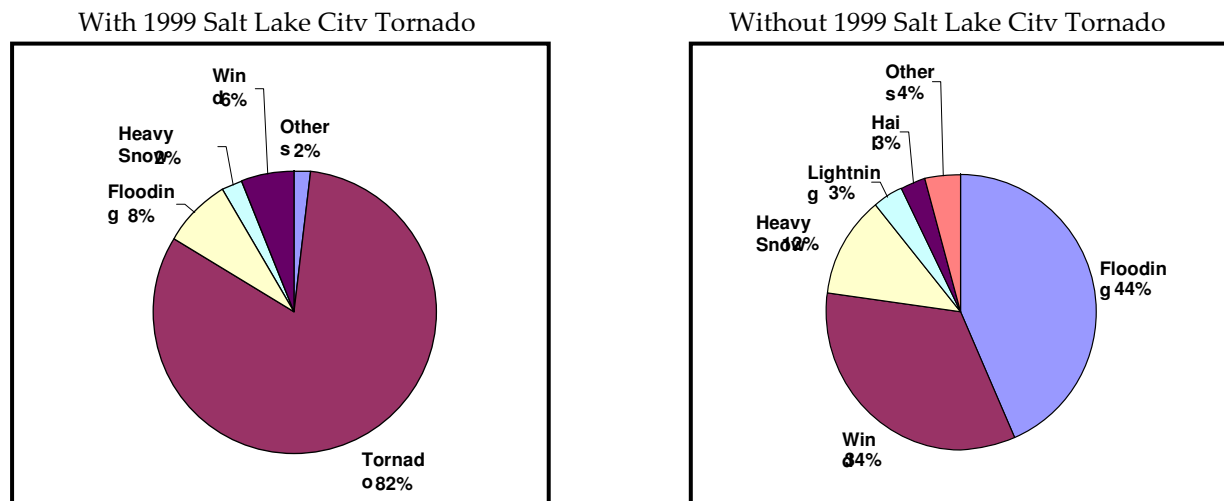


Figure 11-3. Hazard Property Loss Comparison, with and without 1999 Salt Lake City Tornado (HVRI 2007)

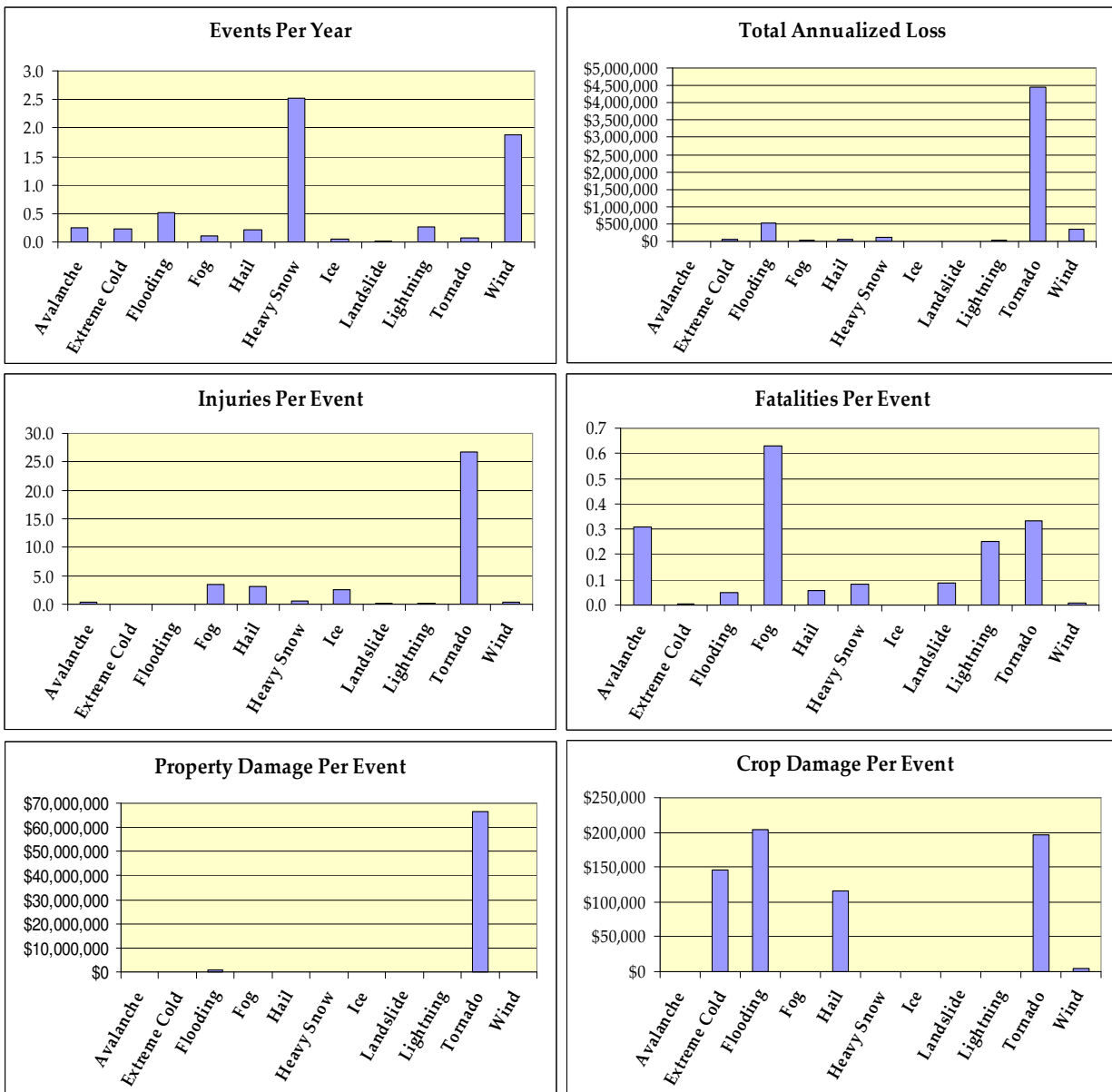


Figure 11-4. Major Disaster Event Annual and Per Event Averages 1962-2005, Salt Lake County (HVRI 2007)

## Risk Assessment

A risk assessment hazard profile was completed for the following identified hazards: earthquake, wildland fire, flood, dam failure, slope failure, severe weather, drought, radon, and infestation. Severe weather, drought, radon and infestation are considered to be regional hazards and can be found in Part VIII. Table 11-1 identifies the highest level of risk each incorporated and unincorporated area has to each identified hazard. Table 11-1 examines vulnerability for critical facilities. Refer to Part VII for an explanation of the risk assessment process.

Number of Structures with Moderate or Greater Vulnerability (% of Total)								
Critical Facilities	Total	<i>Dam Failure</i>	<i>Flood</i>	<i>Ground Shaking</i>	<i>Liquefaction</i>	<i>Problem Soils</i>	<i>Slope Failure</i>	<i>Wildfire</i>
Amateur Radio Repeaters	64	2 (3%)	0 (0%)	64 (100%)	5 (8%)	0 (0%)	5 (8%)	10 (16%)
Public Safety Repeaters	11	0 (0%)	0 (0%)	11 (100%)	5 (46%)	0 (0%)	3 (33%)	5 (46%)
Electric Generation Facilities	5	2 (40%)	1 (20%)	5 (100%)	2 (40%)	0 (0%)	1 (20%)	0 (0%)
Emergency Operations Centers	15	1 (7%)	1 (7%)	15 (100%)	10 (67%)	0 (0%)	0 (0%)	0 (0%)
Fire Stations	57	4 (7%)	3 (5%)	57 (100%)	26 (46%)	0 (0%)	2 (4%)	1 (2%)
Hospitals	30	2 (7%)	0 (0%)	30 (100%)	12 (40%)	0 (0%)	2 (7%)	0 (0%)
Oil Facilities	2	0 (0%)	0 (0%)	2 (100%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)
Police Stations	25	5 (20%)	1 (4%)	25 (100%)	19 (76%)	0 (0%)	0 (0%)	0 (0%)
Schools	246	25 (10%)	0 (0%)	246 (100%)	108 (44%)	0 (0%)	0 (0%)	1 (1%)
Water Treatment Facilities	7	2 (29%)	2 (29%)	7 (100%)	2 (29%)	1 (14%)	2 (29%)	1 (17%)

**Table 11-1. Critical Facilities Vulnerability Matrix for Local Hazards, Salt Lake County** NA=Not Applicable

# 1. Earthquake

## Hazard Profile

<i>Potential Magnitude</i>	X	Catastrophic (>50%)	<i>Probability</i>		Highly Likely
		Critical (25-50%)		X	Likely
		Limited (10-25%)			Possible
		Negligible (< 10%)			Unlikely
<i>Location</i>	Ground shaking will be felt throughout the entire county. Surface fault rupture can be found in areas of known historic fault movements. Liquefaction can be expected in areas of high to moderate liquefaction potential.				
<i>Seasonal Pattern</i>	None.				
<i>Conditions</i>	Liquefaction potential within areas with shallow ground water. Soil that is comprised of old lakebed sediments. Historic movement along faults. Intermountain Seismic Zone, Wasatch Fault.				
<i>Duration</i>	Actual ground shaking will be under one minute, aftershocks can occur for weeks or even months.				
<i>Secondary Hazards</i>	Fire, landslide, rock falls, avalanche, flooding.				
<i>Analysis Used</i>	Review of hazard analysis plans and other information provided by the University of Utah Seismograph Station, UGS, USGS, DHLS, AGRC.				

## Description of Location and Extent

The Wasatch Fault is an active fault zone located in Salt Lake County. The Wasatch Fault is roughly 200 miles long and is broken down into ten segments that can rupture separately during earthquakes. There are six major segments of the Wasatch Fault. From north to south these are known as the Brigham City segment, Weber segment, Salt Lake City segment, Provo segment, Nephi segment and the Levan segment. Within the Salt Lake City segment are three smaller segments from north to south known as Warm Springs Fault, Virginia Street Fault and the East Bench Fault.

The Wasatch Fault Zone appears to be one of the most frequent sources of large earthquakes. Also, because of geologic conditions, the secondary threats of earthquakes are high. Recent evaluation of the earthquake potential along the Wasatch Front indicates that a normal fault zone earthquake could measure in excess of 7 on the Richter scale and could happen about once every 300-400 years.

Name	Fault Type	Length (km)	Time of Most Recent Deformation	Recurrence Interval
East Great Salt Lake fault zone, Antelope Island section	Normal	35	586±201/-241 cal yr B.P.	4,200 years
Wasatch fault zone, Salt Lake segment	Normal	43	1,300±650 cal yr B.P.	1,300 years
West Valley fault zone, Granger segment	Normal	16	1,500±200 cal yr B.P.	2,600-6,500 years
West Valley fault zone, Taylorsville segment	Normal	15	2,200±200 cal yr B.P.	6,000-12,000 years
<b>Table 11-2. Quaternary Faults, Salt Lake County</b> (UGS 2002, UGS 2006) cal yr B.P.=calendar years before present				

Other faults within Salt Lake County include the West Valley Fault Zone and the East Great Salt Lake Fault Zone. Each of these fault zones has much longer return interval (2,500 years or more) and is not expected to produce a major quake in the near future.

Significant earthquakes have occurred in Salt Lake County within the last 50 years. In 1962, a 5.2 Richter magnitude quake jolted the Magna area. In 1992, a magnitude 4.2 quake shook the southern portion of the County. For a map of earthquake epicenter distribution, see Map 11-2 (page 195).

Maps 11-3 and 11-4 represent probabilistic maps of ground shaking potential within Salt Lake County for a 2500-year event. This represents an event with an approximate magnitude of 7.5 on the Richter scale. Spectral acceleration of 0.2 seconds represents the frequency of shaking which affects primarily one- and two-story buildings. 1.0 second spectral acceleration represents the frequency most likely to affect buildings 3 stories or higher. Values are represented as a percent of the force of gravity. Ten percent of gravity (0.1G) is the threshold at which poorly-built structures begin to suffer significant damage (FEMA 1995).

Liquefaction is one of the secondary hazards associated with an earthquake and affects nearly all of Salt County. The County is located atop the ancient Lake Bonneville lakebed, which is made up of unconsolidated sandy soils. Much of the valley is also subject to shallow ground water and a relatively high earthquake threat. These three factors are prevalent in the northern quarter of the County. For a further explanation of the liquefaction threat, see Map 11-5 (page 198). The regional hazard identification section also provides a narrative explanation of liquefaction.

## **Vulnerability Assessment**

Vulnerability of people and infrastructure to earthquake hazards in Salt Lake County was obtained from the modeling program Hazards United States – Multi-hazards (HAZUS-MH).\*\* The following numbers were based on a probabilistic 2500-year event with a Richter magnitude of 7.1 as well as an arbitrary 5.9 event located in close proximity to the county's most populated areas. These locations and magnitudes were chosen for their likelihood and proximity respectively. Default HAZUS-MH inventory for all infrastructure was used. (\*\*For a more detailed explanation of the loss estimation methodology of HAZUS-MH MR2, please see Part VI or the HAZUS-MH Technical Manual (Earthquake Model) at [www.fema.gov/hazus](http://www.fema.gov/hazus)).

### **Building Damage**

HAZUS-MH classifies building damage into five states: none, slight, moderate, extensive and complete. Table 11-3 lists the number of buildings by occupancy estimated to sustain moderate to complete levels of damage during an arbitrarily-determined Richter magnitude 5.9 (M5.9) earthquake scenarios or a probabilistic Richter magnitude 7.1 (M7.1) earthquake scenario. Also listed are the estimated monetary losses to structures, contents/inventory, and income.

Category	Number of Structures with > 50% Damage		Category	Estimated Losses	
	Salt Lake M5.9	2500-yr M7.1		Salt Lake M5.9	2500-yr M7.1
Residential	30,342	157,705	Structural Losses	\$519,320,000	\$3,419,030,470
Commercial	1,896	5,199	Non-Structural Losses	\$1,818,647,000	\$12,331,504,070
Industrial	495	1,367	Content Losses	\$719,709,000	\$4,114,455,740
Government	167	475	Inventory Losses	\$29,216,000	\$175,756,410
Education	51	159	Income and Relocation Losses	\$623,140,000	\$3,263,449,580
Totals	32,951	164,905	Totals	<b>\$3,710,032,000</b>	<b>\$23,304,196,270</b>

**Table 11-3. Building Damage Counts and Estimated Losses**

### Transportation and Utilities Damage

Damages to transportation and utility infrastructure are in Table 11-4. Infrastructure sustaining moderate or worse damage and estimated monetary losses are both shown.

Category	Total	At Least Moderate Damage >50%		Estimated Losses	
		Salt Lake M5.9	2500-yr M7.1	Salt Lake M5.9	2500-yr M7.1
Waste Water Facilities	5	2	4	\$44,008,000	\$146,243,000
Waste Water Pipelines	3,975 km	637 leaks/breaks	14,005 leaks/breaks	\$2,294,000	\$50,416,000
Potable Water Pipelines	6,625 km	805 leaks/breaks	17,706 leaks/breaks	\$2,900,000	\$63,744,000
Natural Gas Pipelines	2,650 km	681 leaks/breaks	14,970 leaks/breaks	\$2,452,000	\$53,893,000
Electrical Power Facilities	7	3	7	\$92,024,000	\$343,874,000
Communication Facilities	42	9	34	\$242,000	\$1,478,000
Highway Bridges	698	126	496	\$81,646,000	\$468,944,000
Railway Bridges	17	0	8	\$9,000	\$358,000
Railway Facilities	6	0	6	\$3,494,000	\$7,525,000
Bus Facilities	2	0	2	\$490,000	\$1,157,000
Airport Facilities	3	0	3	\$2,675,000	\$7,450,000
Total Losses				\$232,234,000	\$1,145,082,000

**Table 11-4. Damage to Transportation and Utilities**

### Debris Removal

Table 11-5 shows how much debris would be generated by the earthquake and how many loads it would take to remove the debris, based on 25 tons per load. One truck can likely haul one load per hour. A second debris removal issue is landfill space. Fifty thousand tons at a weight-to-volume ratio of one ton per cubic yard would cover more than ten acres to a depth of three feet.

Category	Salt Lake M5.9	2500-yr M7.1
Brick, Wood & Others	581,000 tons / 23,240 loads	3,356,000 tons / 134,240 loads
Concrete & Steel	1,195,000 tons / 47,800 loads	7,678,000 tons / 307,120 loads

**Table 11-5. Debris Generated/Number of Loads**

### Fire Following

Multiple ignitions and broken water mains following an earthquake can make firefighting nearly impossible. HAZUS-MH uses estimated building damages, loss of transportation infrastructure and estimated winds to calculate the estimated area that would be burned following an earthquake. Table 11-6 provides estimates of ignitions, people at risk and the building stock exposed to fires following an earthquake.

Category	Number of Structures	
	Salt Lake M5.9	2500-yr M7.1
Ignitions	49	80
Persons Exposed	806	2,116
Value Exposed	\$50,232,000	\$120,188,000

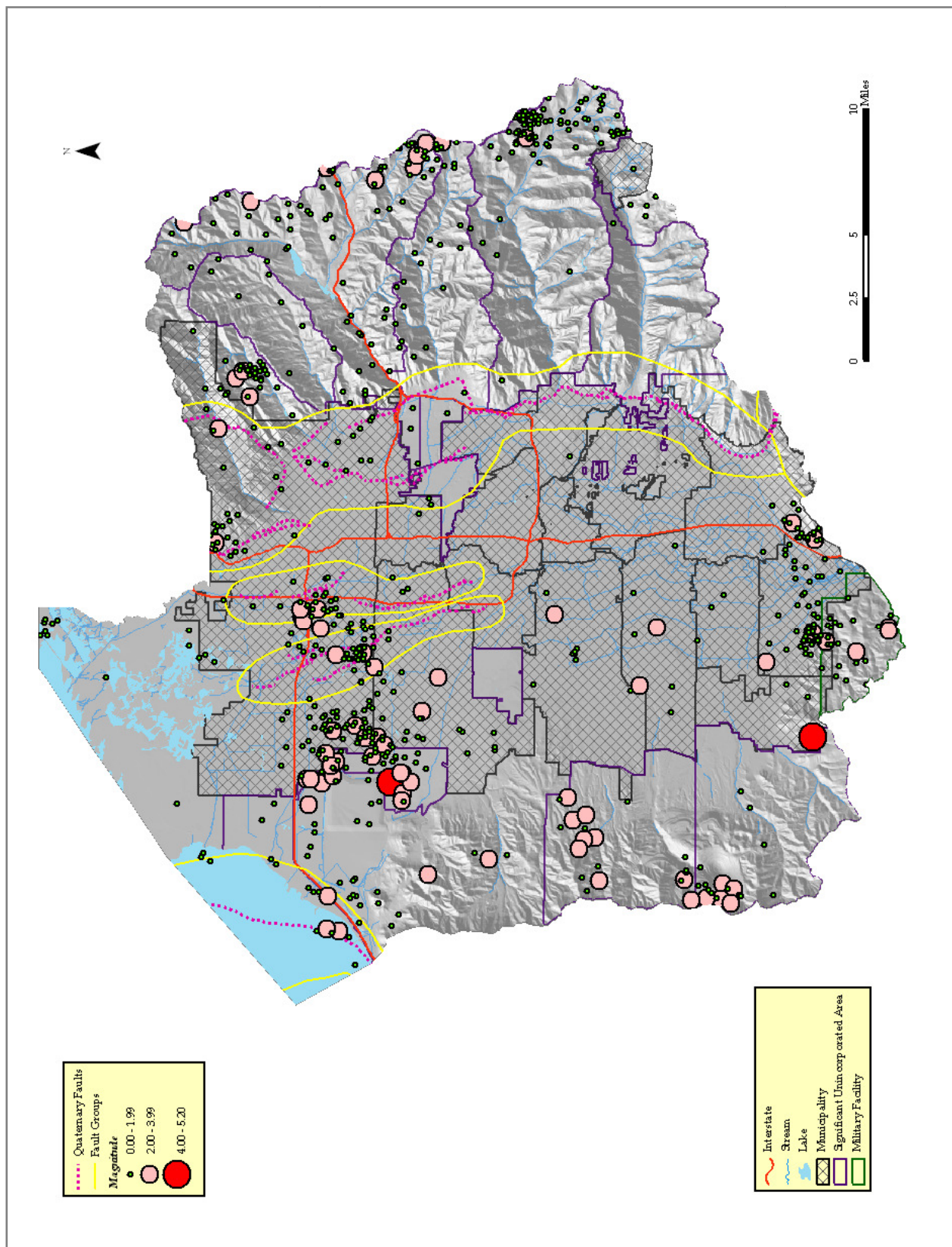
**Table 11-6. Fire Following Event, Population Exposed, and Building Stock Exposed**

### Casualties

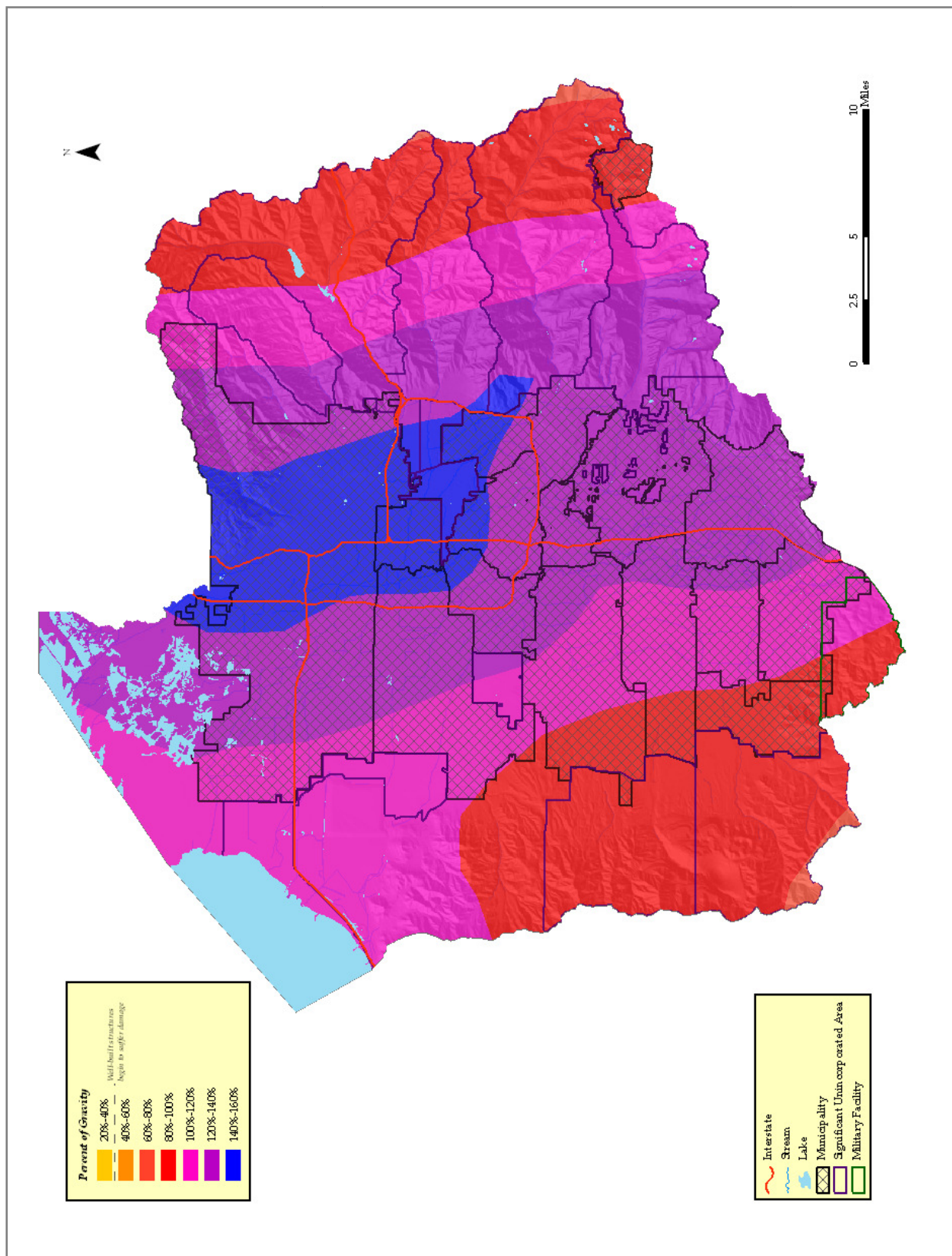
Table 11-7 estimates casualties likely to occur during each earthquake scenario. The nighttime scenario (2 a.m. local time) assumes a primarily residential concentration of persons, the daytime scenario (2 p.m. local time) a commercial concentration, and the commute scenario (5 pm. local time) a concentration of persons on commuting routes. Categories of casualties include those not requiring hospitalization (minor), those requiring treatment at a medical facility (major), and fatalities.

Night Event	Salt Lake M5.9	2500-yr M7.1	Day Event	Salt Lake M5.9	2500-yr M7.1	Commute Event	Salt Lake M5.9	2500-yr M7.1
Minor	1,024	10,475	Minor	1,883	17,110	Minor	1,432	13,442
Major	219	3,224	Major	502	6,192	Major	369	4,688
Fatalities	44	758	Fatalities	122	1,742	Fatalities	87	1,258

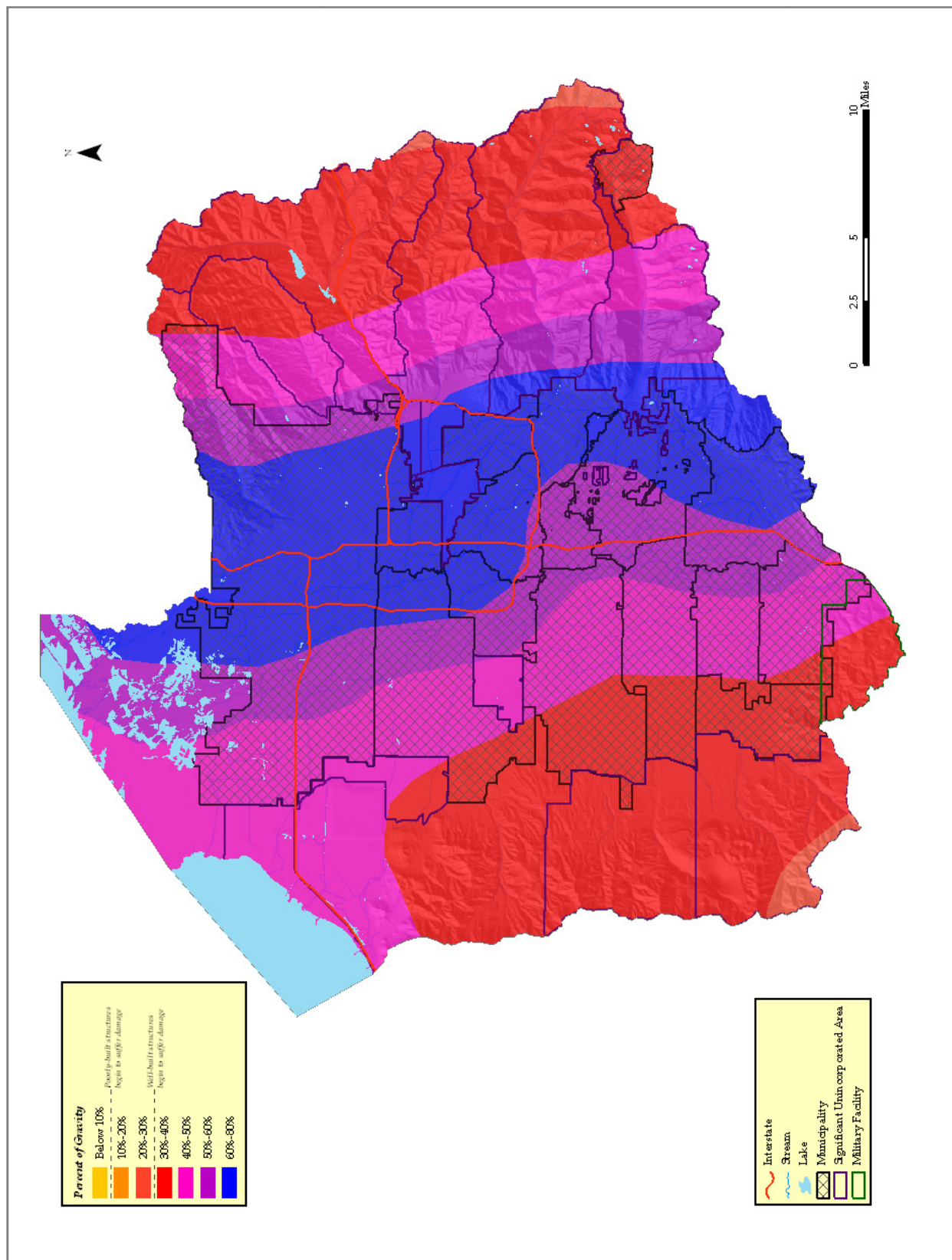
**Table 11-7. Casualties**



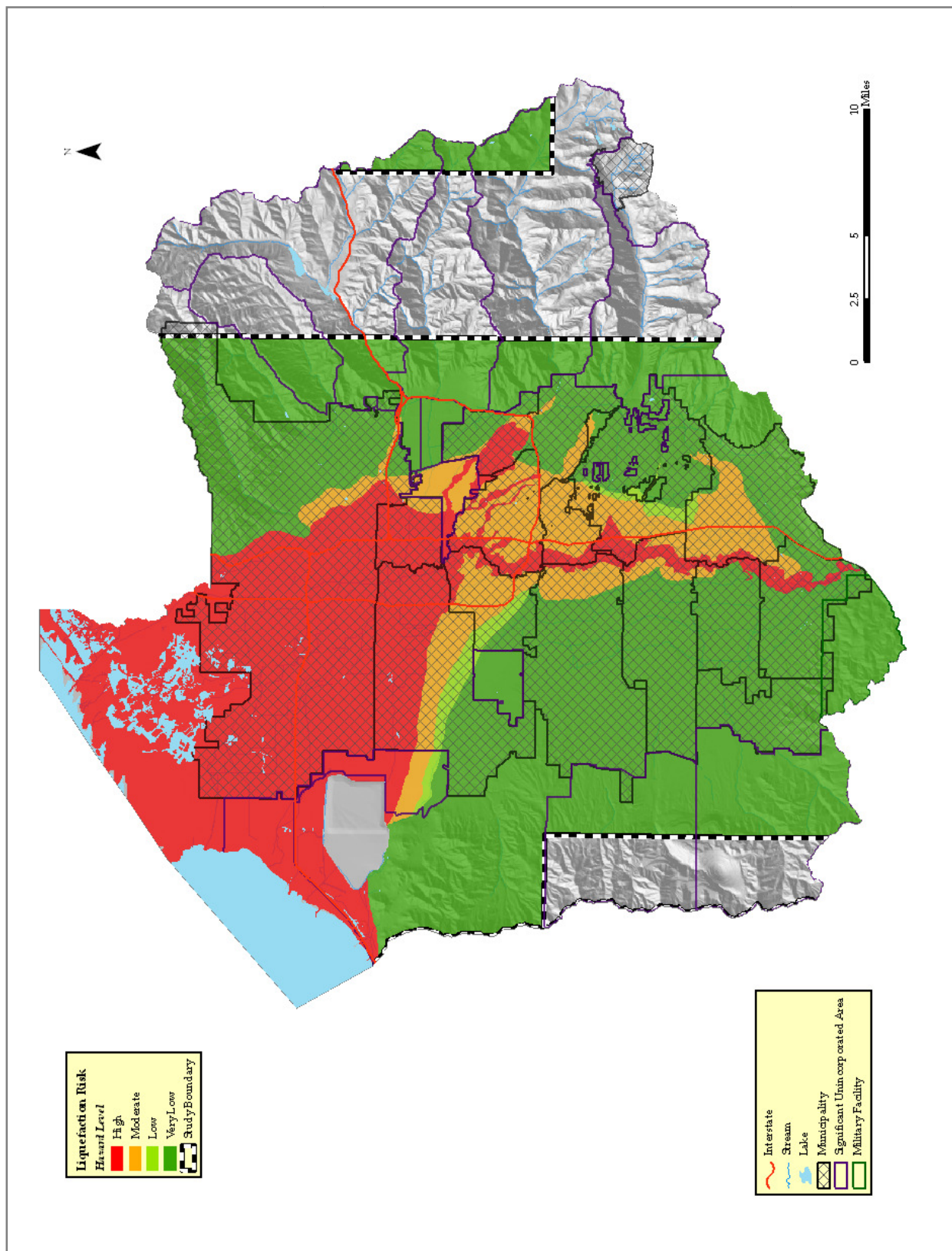
Map 11-2. Salt Lake County Earthquakes, 1962-2005 (UOSS 2007)



Map 11-3. 0.2-Second Spectral Acceleration, Salt Lake County (NSHMP 2002)



Map 11-4. 1.0-Second Spectral Acceleration, Salt Lake County (NSHMP 2002)



**Map 11-5. Liquefaction Susceptibility, Salt Lake County (Christenson and Shaw 2008)**

## 2. Wildland Fire

### Hazard Profile

<i>Potential Magnitude</i>		<i>Catastrophic (&gt;50%)</i>	<i>Probability</i>		<i>Highly Likely</i>
	X	<i>Critical (25-50%)</i>		X	<i>Likely</i>
		<i>Limited (10-25%)</i>			<i>Possible</i>
		<i>Negligible (&lt; 10%)</i>			<i>Unlikely</i>
<i>Location</i>	Wildland-Urban Interface (WUI) zones near the foothills and in forested areas (see Map 11-6, page 202).				
<i>Seasonal Pattern</i>	June-October.				
<i>Conditions</i>	Areas affected by drought; heavily overgrown and dry brush and debris; lightning and human triggers.				
<i>Duration</i>	Days to months; depends on climate and fuel load as well as resources (financial, manpower) to extinguish the fire.				
<i>Secondary Hazards</i>	Landslides, debris flows/flash floods, erosion, traffic accidents, air pollution.				
<i>Analysis Used</i>	Review of plans and data provided by US Forest Service, FFSL, FEMA, AGRC, County Hazard Analysis Plans, and DHLS.				

### Description of Location and Extent

The portions of Salt Lake County that could experience the most significant amount of destruction due to a wildland fire include the foothills and the bench areas on or near the Wasatch Range, Traverse Mountain and the Oquirrh. These WUI areas are threatened most because of the amount of forested lands and the increasing population growth spreading into the foothills. Another concern is vegetation type in these areas such as sagebrush, mountain scrub oak, cheat grass, pinion and juniper trees, and rural and riparian vegetation. Sagebrush burns hot and fast, spreads easily and is found throughout the county. Mountain shrub also burns hot and fast and is one of the more dense types of vegetation throughout the county. During prime burning conditions (hot, dry and windy) the pinion juniper class will burn.

As population growth continues, pressure to develop in WUI areas is likely to increase the threats associated with fire. Mitigation measures will need to be recognized and enforced to reduce these threats.

Past wildfires in Salt Lake County have had a significant impact on watersheds, resulting in slope failure, debris flows and other forms of erosion. State and local agencies have worked together to enhance ordinances and other measures to protect County watersheds.

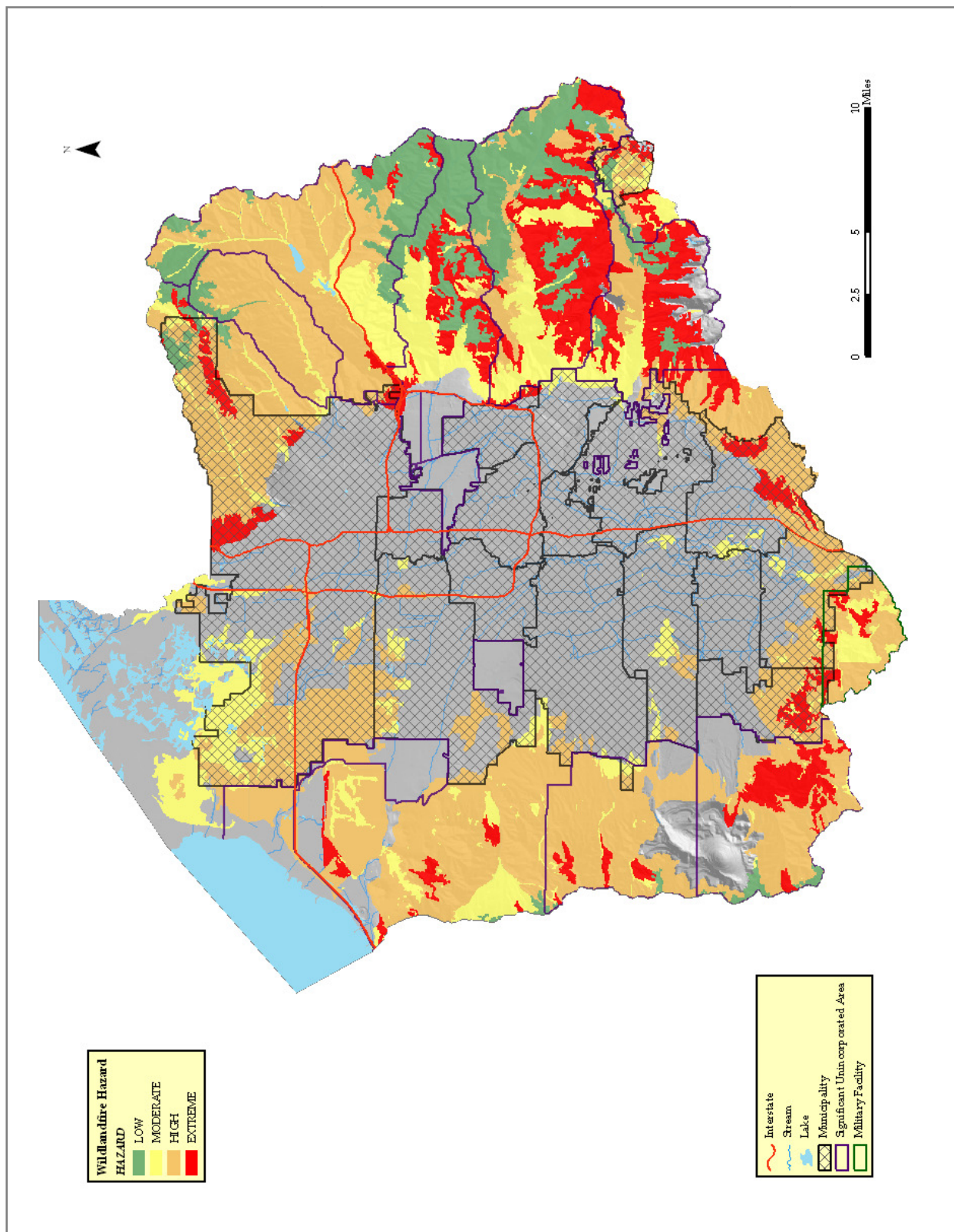
### Vulnerability Assessment

Table 11-8 estimates infrastructure vulnerable to wildland fire in Salt Lake County. Provided are the number of units or total length of infrastructure vulnerable and the estimated replacement costs as provided by HAZUS-MH lost estimation software. Table 11-9 and Table 11-10 estimate the total area, population and buildings vulnerable to wildland fire for individual cities and unincorporated areas.

Item	Length (Miles) or Number of Units	Replacement Cost
Highways/Interstates	366.71 miles	\$1,991,590,683
Highway Bridges	608 bridges	\$1,298,659,176
Railway Segments	179.70 miles	\$206,434,364
Railway Bridges	17 bridges	\$2,275,560
Water Distribution Lines	N/A	N/A
Gas Lines	N/A	N/A
Sewer Lines	N/A	N/A
<i>Total Estimated Infrastructure Replacement Cost</i>		\$3,498,959,783
<b>Table 11-8. Infrastructure Vulnerable to Wildland Fire, Salt Lake County</b>		

Incorporated Areas	Acres in Wildfire Risk Area	Population Affected	Structures in Areas of Moderate or Greater Hazard	
			Residential (Replacement Value)	Commercial (Annual Sales)
Alta	2,030	723	348 \$71,200,800	0
Bluffdale	5,227	584	100 \$35,995,600	22 \$52,329,256
Cottonwood Heights	5,763	213	67 \$13,708,200	9 \$3,517,434
Draper	7,664	6,128	2,934 \$599,061,540	113 \$44,163,338
Herriman	8,212	1,385	908 \$185,232,600	143 \$55,888,140
Holladay	0	0	0	0
Kearns	0	0	0	0
Magna	4,064	170	48 \$9,908,400	10 \$4,188,691
Midvale	0	0	0	0
Murray	0	0	0	0
Riverton	247	1,502	429 \$85,545,142	12 \$8,018,261
Salt Lake City	10,783	1,435	410 \$83,640,000	60 \$209,789,232
Sandy City	1,463	789	228 \$47,648,800	16 \$529,697,373
South Jordan	2,800	0	0	0
South Salt Lake	0	0	0	0
Taylorsville	0	0	0	0
West Jordan	222	0	0	0
West Valley City	2,591	0	0	44 \$525,835,874
<b>Table 11-9. Vulnerability Assessment for Wildland Fire, Salt Lake County</b>				

Unincorporated Areas	Acres Affected	Population Affected	Structures in Areas of Moderate or Greater Hazard	
			Residential (Replacement Value)	Commercial (Annual Sales)
Big Cottonwood Canyon	35,274	603	71 \$52,116,600	0 \$0
Camp Williams	14,873	428	0 \$0	0 \$0
Canyon Rim	0	0	0 \$0	0 \$0
Copperton	0	0	0 \$0	0 \$0
East Millcreek	1,969	2,640	301 \$240,080,600	9 \$8,652,009
Emigration Canyon	11,979	3,764	1,457 \$298,102,200	31 \$13,809,838
Granite	0	0	0 \$0	0 \$0
Millcreek	0	0	0 \$0	0 \$0
Mount Olympus	19,692	2,671	559 \$8,171,400	222 \$73,649,211
Parley's Canyon	34,254	6,688	2,428 \$496,768,800	1 \$530,390
Sandy Hills	249.7	6,052	1,849 \$378,305,400	48 \$15,254,384
Southwest	3,568	931	1,395 \$285,417,000	24 \$10,841,802
Willow Canyon	66	132	22 \$4,525,200	0 \$0
<b>Table 11-10. Vulnerability Assessment for Wildland Fire, Unincorporated Salt Lake County</b>				



Map 11-6. Wildfire Hazard Map, Salt Lake County (UDFFSL 2007)

### 3. Flood

#### Hazard Profile

<i>Potential Magnitude</i>		<i>Catastrophic (&gt;50%)</i>	<i>Probability</i>		<i>Highly Likely</i>
	X	<i>Critical (25-50%)</i>		X	<i>Likely</i>
		<i>Limited (10-25%)</i>			<i>Possible</i>
		<i>Negligible (&lt; 10%)</i>			<i>Unlikely</i>
<i>Location</i>	Largely in and along floodplains (See Maps 11-7 and Map 11-8); debris flows could cause natural damming of water if nearby streams were to become blocked.				
<i>Seasonal Conditions</i>	Spring, heavy rainfall, and spring snowmelt runoff.				
<i>Conditions</i>	Thunderstorms w/heavy rainfall, extended wet periods.				
<i>Duration</i>	Flooding can last anywhere from hours to days and even months.				
<i>Secondary Hazards</i>	Raw sewage/health risk, electrical fires, gas spills.				
<i>Analysis Used</i>	Review of FIS, FIRM, Army Corp of Engineers Flood Study.				

#### Description of Location and Extent

Flooding in Salt Lake County is similar to the rest of the region in that it is typically the result of excessive snowmelt runoff and/or heavy rainfall. Snowmelt flooding is usually the result of rapid melting of snowpack and occurs between April through June. Thunderstorms can produce high intensity, short duration heavy rainfall that occurs over a relatively small area in the summer months. However, flooding can occur from non-thunderstorm rainfall events. Refer to Maps 11-7 and 11-8 (pages 206 and 207).



**September 1982 flooding in Big Cottonwood Canyon** (Photo by David Carpenter.) (Source: <http://www.utahweather.org/>)

The major waterways in the County include the Jordan River, Big and Little Cottonwood Creeks, Parley's Creek, Emigration Creek, Red Butte Creek, City Creek, Lambs Creek, Dell Creek and Millcreek. All have the potential to flood. However, the major floods of 1983-84 and other flood events resulted in the incorporation of significant flood mitigation measures that greatly reduced the flood threat.

The flows of the Jordan River are controlled and the flood potential is reduced. Parley's Creek has flood storage capacity at Mountain Dell and Little Dell Reservoirs and is routed through a

retention basin in Sugarhouse Park. Big and Little Cottonwood Creeks and Bell's Canyon have a number of smaller flood storage lakes and ponds providing some minimal flood protection. In Salt Lake City, Emigration Creek and Red Butte Creek come together at 700 East and 300 South and can be discharged in or bypass Liberty Park pond. Parley's Creek discharges to the 1300 South drain at State Street.

The potential for flooding is greatest for heavy rainfall events, usually from thunderstorms during peak flow times. Areas to monitor include 13th South between 700 East and State Street, 7th West and North Temple Streets. Retention ponds are also used to store runoff from commercial and residential development areas.

During the past 149 years, the Great Salt Lake has peaked three times above 4,211 feet above sea level: 4,211.60 feet in June 1873, 4,211.50 feet in June 1986 and 4,211.60 feet in June 1987.



**Great Salt Lake Flooding, Salt Air Resort** (Photo courtesy of the National Weather Service.) (Source: <http://www.utahweather.org/>)

This picture of the Saltair Resort on the southeast shore of the Great Salt Lake was taken during the flood years of the 1980s. Large pumps were installed on the west side of the Great Salt Lake (at a cost of \$60 million) and began pumping water into the west desert in 1987. These pumps are currently inoperable, but could be reactivated if necessary (Utah Department of Water Resources 2007b).

## Vulnerability Assessment

The vulnerability assessment for flooding in Salt Lake County was obtained from HAZUS-MH\*\*. Vulnerability was assessed for both 100-year (NFIP Zone A) and 500-year (NFIP Zone B or Zone X (shaded) flood events. Analysis was completed using Digital Flood Insurance Rate Maps (DFIRM). Only streams which contained detailed flood cross-section data could be used. Flooding from the Great Salt Lake was not included. Consequently, the results should be considered conservative. Total monetary losses include structures, contents and business interruption. (\*\*For a more detailed explanation of the loss estimation methodology of HAZUS-MH MR2, please see Part VI or the HAZUS-MH Technical Manual (Flood Model) at [www.fema.gov/hazus](http://www.fema.gov/hazus)).

	Acres Flooded	Population Displaced	Number of Structures in Floodplain	
			Residential Units (Total Losses)	Commercial/Industrial Units (Total Losses)
100-year Flood	2,588.7	13,777	2,255 \$342,730,000	47 \$331,750,000
500-year Flood	8,346.4	14,613	2,490 \$409,820,000	47 \$401,500,000

**Table 11-11. Salt Lake County Flood Hazard**

## Agricultural Losses

Agricultural losses are listed in Table 11-12 (page 202). Losses are computed according to the number of days in which the crops are inundated with water. All numbers are estimated for a flood occurring near April 15th.

	100-year Losses Day 3	100-year Losses Day 7	500-year Losses Day 3	500-year Losses Day 7
<b>Barley</b>	\$45,134	\$60,179	\$49,078	\$65,438
<b>Corn Silage</b>	\$565,932	\$754,577	\$566,310	\$820,518
<b>Table 11-12. Agricultural Losses, April 15<sup>th</sup> Scenario</b>				

### Vehicle Losses

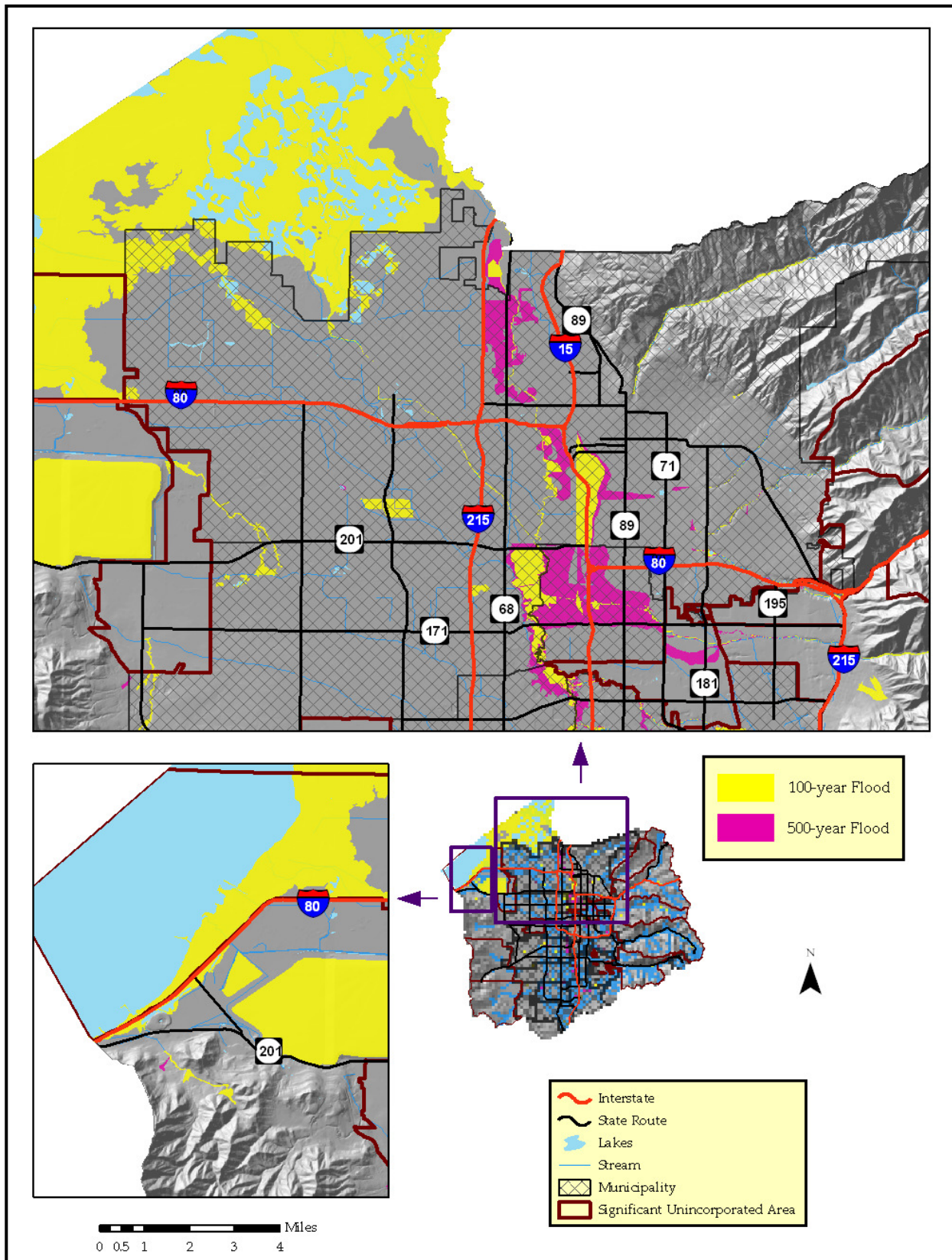
Table 11-13 contains losses for vehicles in floods during both daytime and nighttime scenarios. The scenarios assume ninety percent (90%) of vehicles being removed from hazard areas due to warning.

Category	100-year	500-year
<b>Daytime Scenario</b>	\$8,934,176	\$12,019,101
<b>Nighttime Scenario</b>	\$16,956,505	\$21,976,899
<b>Table 11-13. Vehicle Losses</b>		

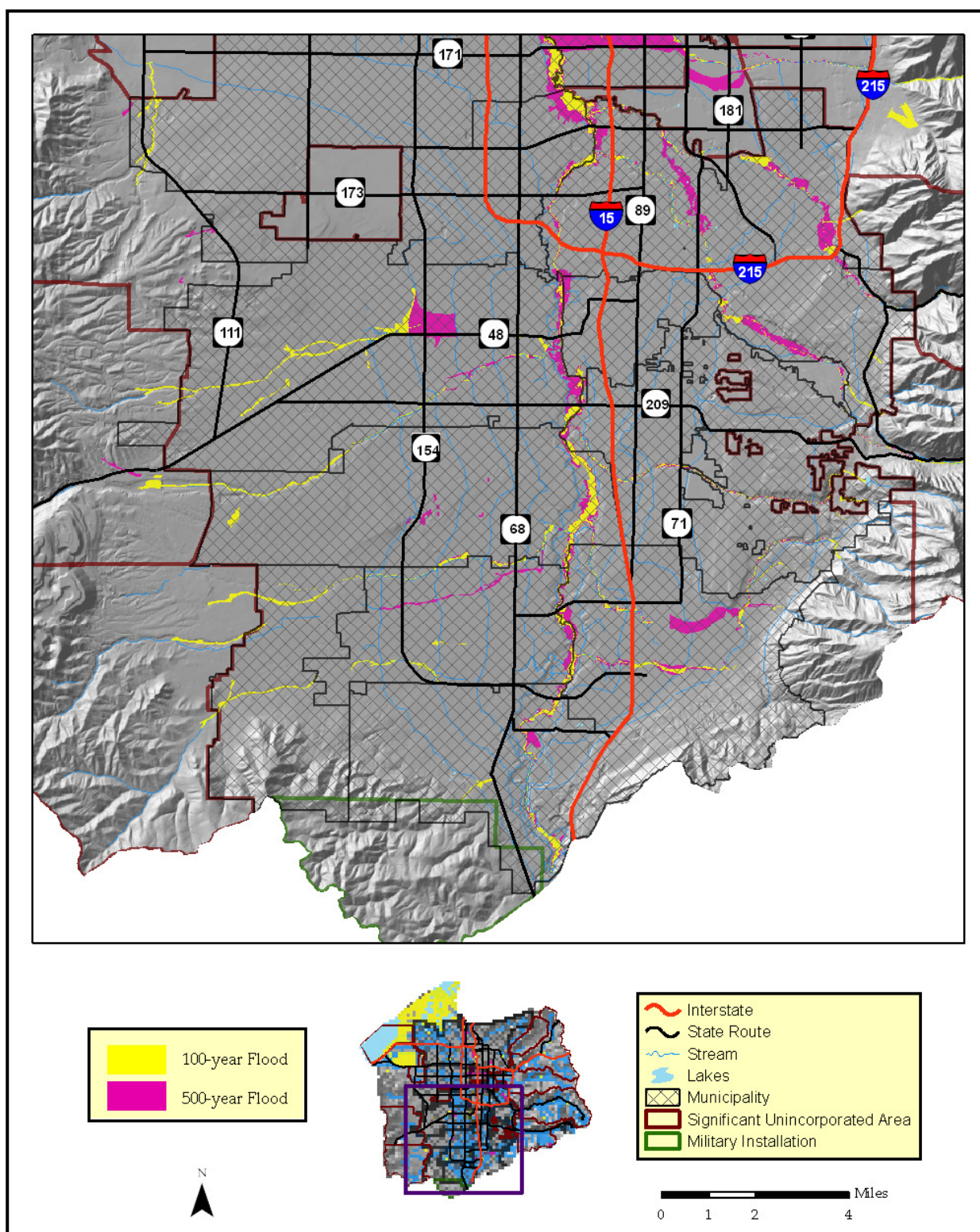
### Debris Removal

Table 11-14 shows how much debris would be generated by flooding and how many loads it would take to remove the debris, based on a capacity of 25 tons per load. One truck can likely haul one load per hour. A second debris removal issue is landfill space. Fifty thousand tons at a weight-to-volume ratio of one ton per cubic yard would cover more than ten acres to a depth of three feet.

Category	100-year	500-year
<b>Finishes</b>	37,402 tons/1,497 loads	44,481 tons/1,780 loads
<b>Structures</b>	64,725 tons/2,589 loads	69,936 tons/ 2,798 loads
<b>Foundations</b>	61,660 tons/2,467 loads	66,747 tons/2,670 loads
<b>Totals</b>	<b>163,786 tons/6,553 loads</b>	<b>181,164 tons/7,248 loads</b>
<b>Table 11-14. Debris Generation and Removal</b>		



Map 11-7. Flood Hazard Map, Northern Salt Lake County (FIMA 2002)



Map 11-8. Flood Hazard Map, Southern Salt Lake County (FIMA 2002)

## 4. Slope Failure

### Hazard Profile

<i>Potential Magnitude</i>		<i>Catastrophic (&gt;50%)</i>	<i>Probability</i>		<i>Highly Likely</i>
		<i>Critical (25-50%)</i>		X	<i>Likely</i>
	X	<i>Limited (10-25%)</i>			<i>Possible</i>
		<i>Negligible (&lt; 10%)</i>			<i>Unlikely</i>
<i>Location</i>	Generally in canyon mouths and foothills; areas of recent wildfire activity (Map 11-9, page 211).				
<i>Seasonal Pattern</i>	Spring and summer months.				
<i>Conditions</i>	Usually caused by the stress release of over-weighted soils or loosening of rock and debris by wind, water or ground shaking.				
<i>Duration</i>	<i>Landslides/Rockfalls</i> : Hours to Months. <i>Debris flows</i> : Instantaneous.				
<i>Secondary Hazards</i>	Flooding (natural dams), traffic accidents.				
<i>Analysis Used</i>	Information and maps provided by UGS, DHLS, AGRC.				

### Description of Location and Extent

Landslides and debris flows are most common in the foothills along the base of the Wasatch Mountain Range from wet climatic conditions. Some major landslide areas include the Grand View Peak rockslide in upper City Creek Canyon, the Baskin Spring landslide in North Salt Lake, the Little Valley Red Rock landslide in Draper and the shallow disrupted landslides in and near Steep Mountain in Draper (refer to Map 11-9). As urbanization spreads into geologically unstable areas of the County, the risk to life and property increases.

The Grand View Peak slide is a candidate for an earthquake-induced landslide. The Baskin Spring slide is a prehistoric slide on the northern flank of the Salt Lake salient. This slide also has a strong susceptibility to seismic failure. The Little Valley Red Rock slide in Draper is the largest in southern Salt Lake County. The Draper Heights landslide is a post Lake Bonneville slide that occurred on the steep north slope of Steep Mountain. This slide is an earthquake triggered soil slide.

Subsidence is possible in City Creek, Emigration, Parley's, and Big Cottonwood Canyons due to the prevalence of dissolvable limestone. Subsidence can also occur in the Avenues area of Salt Lake City and in the Taylorsville-Kearns area due to collapsible soils that are compactable upon wetting (Mulvey 1992).

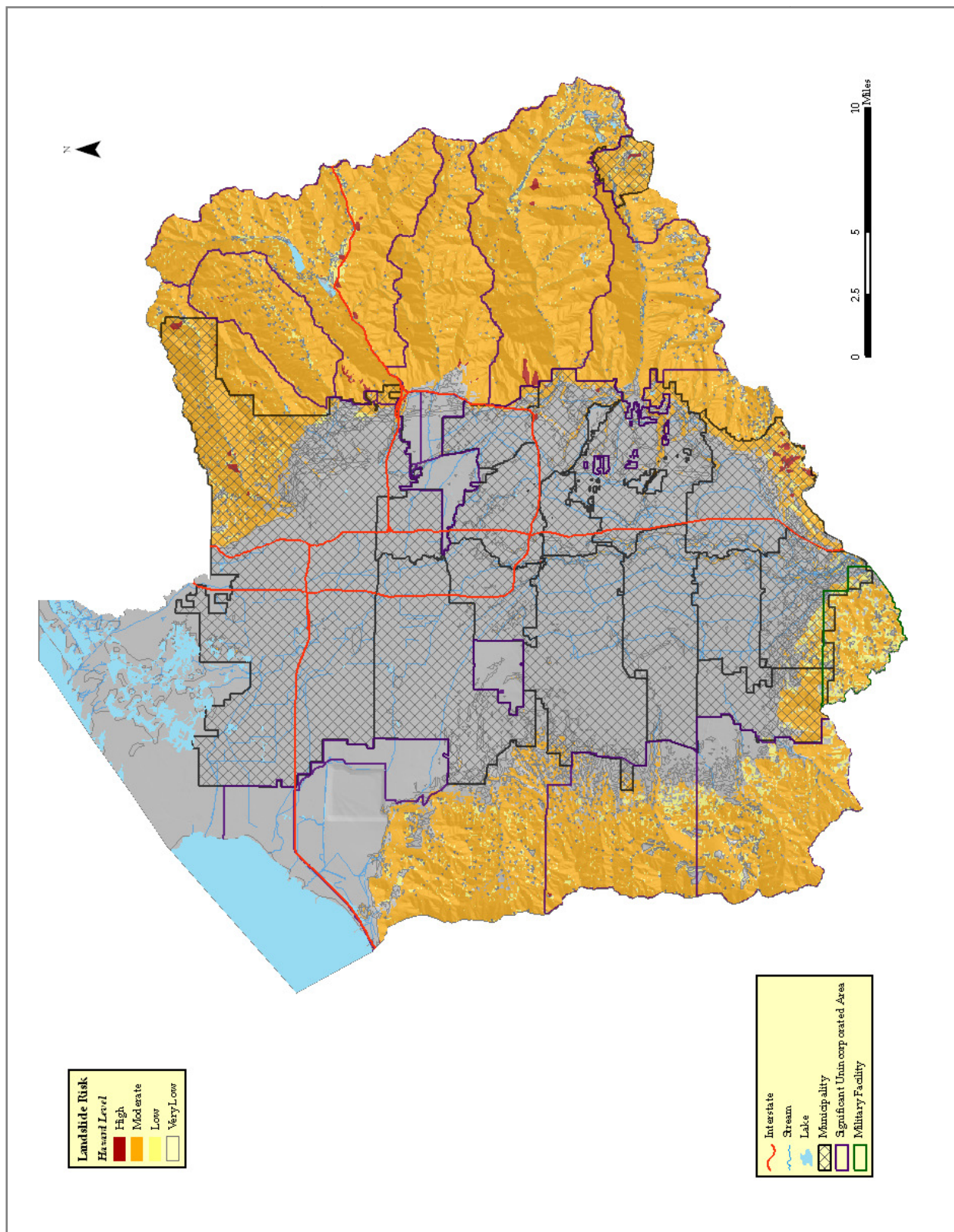
### Vulnerability Assessment

Table 11-15 (below) estimates infrastructure vulnerable to landslides in Salt Lake County. Provided are the number of units or total length of infrastructure vulnerable and the estimated replacement costs as provided by HAZUS-MH lost estimation software. Table 11-16 estimates the total area, population, and buildings vulnerable to landslides for individual cities. Table 11-17 examines the same for unincorporated areas.

Item	Length (Miles) or Number of Units	Replacement Cost
Highways/Interstates	46.86 miles	\$259,322,175
Highway Bridges	38 bridges	\$33,527,413
Railway Segments	4.98 miles	\$5,716,617
Railway Bridges	1 bridges	\$23,520
Water Distribution Lines	609.38 miles	\$19,621,849
Gas Lines	243.64 miles	\$7,848,732
Sewer Lines	365.61 miles	\$11,773,110
<b>Total Estimated Infrastructure Replacement Cost</b>		<b>\$337,833,416</b>
<b>Table 11-15. Infrastructure Vulnerable to Landslides, Salt Lake County</b>		

Incorporated Areas	Acres Affected	Population Affected	Structures in Areas of Moderate or Greater Hazard	
			Residential (Replacement Value)	Commercial (Annual Sales)
Alta	2,477	986	322 \$65,881,200	0
Bluffdale	1,457	3,626	1,061 \$217,080,600	1 \$110,705
Cottonwood Heights	1,296	5,982	2,014 \$412,064,400	93 \$38,368,162
Draper	2,816	8,318	2,380 \$486,948,000	26 \$7,143,464
Herriman	2,508	4,139	1,242 \$254,113,200	0
Holladay	397	1,721	506 \$103,527,600	23 \$3,371,052
Midvale	11	53	18 \$3,682,800	0
Murray	35	258	88 \$18,004,800	4 \$2,407,223
Riverton	75	362	88 \$18,004,800	2 \$120,490
Salt Lake City	15,701	15,762	6,327 \$1,294,504,200	176 \$47,480,280
Sandy City	1,567	8,199	2,301 \$470,784,600	77 \$15,535,108
South Jordan	72	213	60 \$12,276,000	0
South Salt Lake	0	0	0	0
Taylorsville	19	179	55 \$11,253,000	2 \$346,531
West Jordan	368	439	171 \$34,986,600	0
West Valley City	65	59	17 \$3,478,200	0
<b>Table 11-16. Vulnerability Assessment for Landslides, Incorporated Salt Lake County</b>				

Unincorporated Areas	Acres Affected	Population Affected	Structures in Areas of Moderate or Greater Hazard	
			Residential (Replacement Value)	Commercial (Annual Sales)
Big Cottonwood Canyon	32,822	4,635	1,543 \$315,697,800	0
Camp Williams	9,746	5,475.0	1,571 \$321,426,600	2 \$724,308
Canyon Rim	168	2,865	928 \$189,868,800	0
Copperton	14,390	510	215 \$43,989,000	1 \$9,785
East Millcreek	18	162	57 \$11,662,200	1 \$27,753
Emigration Canyon	11,281	3,562	1,378 \$281,938,800	25 \$12,583,730
Granite	17,372	8,817	2,724 \$557,330,400	6 \$2,300,292
Kearns	10	109	31 \$6,342,600	1 \$85,797
Magna	40	254	157 \$32,122,200	0
Millcreek	4	54	20 \$4,092,000	0
Mount Olympus	18,263	5,226	1,706 \$349,047,600	39 \$9,634,013
Parley's Canyon	31,744	6,188	2,245 \$459,327,000	1 \$530,390
Sandy Hills	1	7	2 \$409,200	0
Southwest	15,295	2,383	656 \$134,217,600	7 \$5,411,633
Willow Canyon	5	45	11 \$2,250,600	1 \$387,562
<b>Table 11-17. Vulnerability Assessment for Landslides, Unincorporated Salt Lake County</b> (2006 socioeconomic projections)				



**Map 11-9. Salt Lake County Landslide Hazard** (Giraud and Shaw 2007)

## 4. Dam Failure

### Hazard Profile

<i>Potential Magnitude</i>		<i>Catastrophic (&gt;50%)</i>	<i>Probability</i>		<i>Highly Likely</i>
	X	<i>Critical (25-50%)</i>			<i>Likely</i>
		<i>Limited (10-25%)</i>		X	<i>Possible</i>
		<i>Negligible (&lt; 10%)</i>			<i>Unlikely</i>
<i>Location</i>	Dam locations are primarily in the eastern portion of the county (Map 11-10, page 216).				
<i>Seasonal Conditions</i>	<i>Rainy Day Failure:</i> Spring, late summer <i>Sunny Day Failure:</i> Anytime				
<i>Conditions</i>	<i>Rainy Day Failure</i> happens mainly during heavy precipitation events, can have some warning time. <i>Sunny Day Failure</i> can happen anytime without warning.				
<i>Duration</i>	Hours or days - depends on spillway type and area, maximum cubic feet per second (cfs) discharge, overflow or breach type and dam type.				
<i>Secondary Hazards</i>	Raw sewage/health risk, electrical fires, gas spills.				
<i>Analysis Used</i>	Review of BOR inundation maps and plans, FIS, Utah Division of Water Rights.				

### Description of Location and Extent

Twenty-seven “high-hazard” dams and other irrigation impoundments are located in Salt Lake County, according to the Utah Division of Water Rights, Dam Safety Inspection agency. A “high-hazard” threat means if the dam were to fail it would have a high probability of causing loss of life and extensive economic loss. The County also has twenty-six “moderate-hazard” dams and other irrigation impoundments; meaning if the dam were to fail it would have a low probability of causing loss of life but would cause appreciable property damage. One hundred and seven dams have a “low-hazard” threat; meaning if the dam were to fail there would be a minimal threat to life and economic losses would be minor. The damage would be limited to the owner of the dam; however, these dams should continue to be monitored. There are sixty-three additional water impoundments with no hazard rating whatsoever. Refer to Table 11-18 for a listing of the high and moderate hazard dams within the County.

The dam safety hazard is classified by the State Engineer. This classification is based upon the damage caused if the dam were to fail, not the dam’s probability of failure. Therefore, the classification of a high hazard dam does not mean that the dam has a high probability of failure.

<b>Name</b>	<b>Rating</b>	<b>Name</b>	<b>Rating</b>
Black Ridge Reservoir – Herriman Dam	High	Sandy City – Storm Mountain Detention Basin	High
Draper Pressure Irrigation Project	High	Twin Lakes (Salt Lake)	High
Ensign Downs Detention Basin (AKA Victory Road DB)	High	White Pine	High
Kennecott Mine – Bingham Creek	High	Barney’s Wash Detention Basin (6400 West)	Mod
Lake Mary – Phoebe	High	Jordan Valley Water Purification Lower	Mod
Little Dell	High	Jordan Valley Water Purification Upper	Mod

Name	Rating	Name	Rating
Mountain Dell	High	Kennecott Mine – 4000 West Pond	Mod
Oquirrh Lake Dam - Kennecott Daybreak	High	Kennecott Mine – Small Reservoir	Mod
Point of the Mountain Raw Water Reservoir	High	Kennecott Smelter – Kessler Canyon #06	Mod
Red Butte Dam	High	Kennecott Smelter – Kessler Canyon #10	Mod
Red Pine	High	Kennecott Smelter – Kessler Canyon #11	Mod
Riverton City – 3200 West Pond	High	Kennecott Smelter – Tailings Pond	Mod
Riverton City – 4200 West Pond	High	Magna Water Company & Improvement District	Mod
Salt Lake County – Big Cottonwood (Spencer's)	High	Monroc	Mod
Salt Lake County – Creekside Park (Big Cottonwood)	High	Oakridge Development	Mod
Salt Lake County – Scott Ave	High	Riverton Dam (Formerly American Contract)	Mod
Salt Lake County – Sugarhouse	High	Salt Lake County – Wheeler Farm	Mod
Salt Lake County – Chandler Drive (#13)	High	Salt Lake County –Upper I-9	Mod
Salt Lake County – Federal Heights (#1A)	High	Sandy City – Alta Canyon	Mod
Salt Lake County – School Pond (#14)	High	Sandy City – Aspen Meadows	Mod
Salt Lake County – Shriners (#12)	High	Sandy City – Buttercup	Mod
Salt Lake County – Rotary Glen Park	High	Sandy City – Crescent Park	Mod
Sandy City – East Sandy Elementary	High	Sandy City – Falcon Detention Basin	Mod
Sandy City – Flat Iron Mesa	High	Sandy City – Willow Creek	Mod
<b>Table 11-18. High and Moderate Hazard Dams, Salt Lake County</b> (Source: Utah Division of Water Rights)			

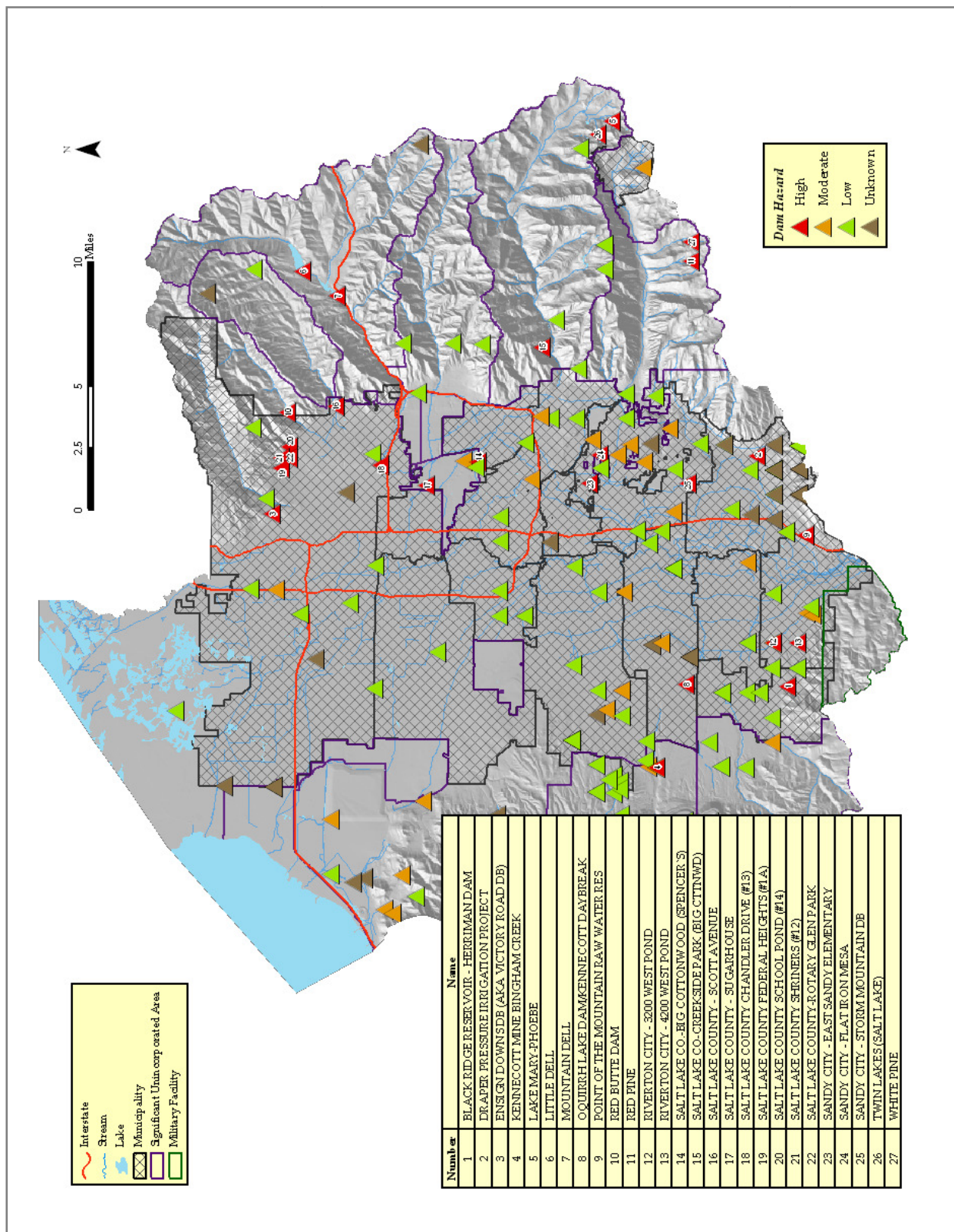
## Vulnerability Assessment

Table 11-19 (below) estimates infrastructure vulnerable to dam failure in Salt Lake County. Provided are the number of units or total length of infrastructure vulnerable and the estimated replacement costs as provided by HAZUS-MH lost estimation software. Table 11-20 estimates the total area, population and buildings vulnerable to dam failure for individual cities and Table 11-21 examines the same for unincorporated areas.

Item	Length (Miles) or Number of Units	Replacement Cost
Highways/Interstates	49.35 miles	\$270,712,431
Highway Bridges	141 bridges	\$194,240,663
Railway Segments	18.68 miles	\$21,462,350
Railway Bridges	0 bridges	\$0
Water Distribution Lines	N/A	N/A
Gas Lines	N/A	N/A
Sewer Lines	N/A	N/A
Total Estimated Infrastructure Replacement Cost		<b>\$486,415,444</b>
<b>Table 11-19. Infrastructure Vulnerable to Dam Failure, Salt Lake County</b>		

Incorporated Areas	Acres Affected	Population Affected	Structures in Inundation Areas	
			Residential (Replacement Value)	Commercial (Annual Sales)
Alta	0	0	0	0
Bluffdale	577	1,066	281 \$57,492,600	9 \$2,792,296
Cottonwood Heights	618	4,299	1,498 \$306,490,800	170 \$68,626,409
Draper	479	1,444	486 \$99,435,600	52 \$126,907,719
Herriman	0	0	0	0
Holladay	1,159	7,369	3,080 \$630,168,000	371 \$232,693,583
Midvale	323	3,714	1,546 \$316,311,600	49 \$33,150,823
Murray	1,066	7,423	3,324 \$680,090,400	715 \$550,016,335
Riverton	853	3,710	969 \$198,257,400	28 \$14,217,055
Salt Lake City	5,487	44,174	18,186 \$3,720,855,600	2,259 \$1,319,027,117
Sandy City	1,357	12,191	4,221 \$863,616,600	442 \$216,962,013
South Jordan	222	474	137 \$28,030,300	1 \$110,705
South Salt Lake	1,719	12,973	5,974 \$1,222,280,400	1,344 \$855,609,248
Taylorsville	1	60	32 \$6,547,200	0
West Jordan	2,126	13,322	3,830 \$783,618,000	313 \$109,253,013
West Valley City	40	324	80 \$16,368,000	16 \$9,492,390
<b>Table 11-20. Vulnerability Assessment for Dam Failure, Incorporated Salt Lake County</b>				

Unincorporated Areas	Acres Affected	Population Affected	Structures in Inundation Areas	
			Residential (Replacement Value)	Commercial (Annual Sales)
Big Cottonwood Canyon	913	55	19 \$3,887,400	0
Camp Williams	0	0	0	0
Canyon Rim	127	936	332 \$67,927,200	0
Copperton	92	1	0	0
East Millcreek	0	0	0	0
Emigration Canyon	0	0	0	0
Granite	328	269	80 \$16,368,000	1 \$27,753
Kearns	0	0	0	0
Magna	0	0	0	0
Millcreek	640	6,428	3,153 \$645,103,800	282 \$180,987,936
Mount Olympus	27	45	13 \$2,659,800	0
Parley's Canyon	708	146	44 \$9,002,400	0
Sandy Hills	25	280	83 \$16,981,800	1 \$27,753
Southwest	0	0	0	0
Willow Canyon	0	0	0	0
<b>Table 11-21. Vulnerability Assessment for Dam Failure, Unincorporated Salt Lake County</b>				



Map 11-10. Dam Hazard Map, Salt Lake County (Utah Division of Water Rights 2007)

## 5. Problem Soils

### Hazard Profile

<i>Potential Magnitude</i>		Catastrophic (>50%)	<i>Probability</i>		Highly Likely
		Critical (25-50%)			Likely
	X	Limited (10-25%)		X	Possible
		Negligible (< 10%)			Unlikely
<i>Location</i>	Wasatch Mountains (Map 11-11, page 221).				
<i>Frequency</i>	Continuous.				
<i>Conditions</i>	Conditions vary by geologic formation.				
<i>Duration</i>	Minutes to Years.				
<i>Secondary Hazards</i>	Flooding (broken water pipes), fire (broken gas pipes).				
<i>Analysis Used</i>	Utah Geological Survey.				

### Description of Location and Extent

Problem soils are soils that present problems for engineered structures. Two types of problem soils are present in Salt Lake County – limestone and expansive soils. Both of these hazards are primarily found in the Wasatch Mountains in the eastern part of the County. See Map 11-11 for more information on the locations of problem soils in Salt Lake County.

Limestone karst structures are easily eroded by water and therefore often form caverns and crevices. If these caverns become large enough, the overlying ground can give way causing sink holes and other forms of subsidence. Structures directly over the karst structure have a high potential for collapse. Ground water contamination is also possible (Mulvey 1992). Fortunately, many of the areas affected by karst structures in Salt Lake County are undeveloped.

Expansive soils can absorb large quantities of water. When a home or road is placed on top of these soils, normal evaporation cannot take place. The clay begins to absorb more water than is evaporated and expands, causing heaving. During especially dry periods, these soils can contract significantly causing subsidence and ground cracking. Residents already living in these areas should avoid excessive watering, make sure sufficient water drainage is in place around the home, and ensure plumbing and irrigation pipes and fixtures are well protected from breakage or leaks (Kalisser 1972).

### Vulnerability Assessment

Table 11-22 (below) estimates infrastructure vulnerable to problem soils in Salt Lake County. Provided are the number of units or total length of infrastructure vulnerable and the estimated replacement costs as provided by HAZUS-MH lost estimation software. Table 11-23 and Table 11-24 estimate the total area, population and buildings vulnerable to problem soils.

Item	Length (Miles) or Number of Units	Replacement Cost
Highways/Interstates	4.81 miles	\$37,544,750
Highway Bridges	8 bridges	\$10,166,037
Railway Segments	0 miles	\$0
Railway Bridges	0 bridges	\$0
Water Distribution Lines	75.86 miles	\$2,441,550
Gas Lines	30.34 miles	\$976,619
Sewer Lines	45.51 miles	\$1,464,931
<i>Total Estimated Infrastructure Replacement Cost</i>		<b>\$52,593,887</b>

**Table 11-22. Infrastructure Vulnerable to Problem Soils, Salt Lake County**

Incorporated Areas	Acres Affected	Population Affected	Structures in Hazard Areas	
			Residential (Replacement Value)	Commercial (Annual Sales)
Alta	0	0	0	0
Bluffdale	0	0	0	0
Cottonwood Heights	0	0	0	0
Draper	0	0	0	0
Herriman	0	0	0	0
Holladay	0	0	0	0
Midvale	0	0	0	0
Murray	0	0	0	0
Riverton	0	0	0	0
Salt Lake City	3,783	1,707	634 \$129,716,400	0
Sandy City	0	0	0	0
South Jordan	0	0	0	0
South Salt Lake	0	0	0	0
Taylorsville	0	0	0	0
West Jordan	0	0	0	0
West Valley City	0	0	0	0

**Table 11-23. Vulnerability Assessment for Problem Soils, Incorporated Salt Lake County**  
(2006 socioeconomic projections)

Unincorporated Areas	Acres Affected	Population Affected	Structures in Hazard Areas	
			Residential (Replacement Value)	Commercial (Annual Sales)
Big Cottonwood Canyon	8,574	41	16 \$3,273,600	0
Camp Williams	0	0	0	0
Canyon Rim	0	0	0	0
Copperton	0	0	0	0
East Millcreek	0	0	0	0
Emigration Canyon	9,373	1,329	520 \$106,392,000	20 \$10,270,878
Granite	0	0	0	0
Kearns	0	0	0	0
Magna	0	0	0	0
Millcreek	0	0	0	0
Mount Olympus	15,714	516	175 \$35,805,000	0
Parley's Canyon	19,814	1,447	557 \$113,962,200	0
Sandy Hills	0	0	0	0
Southwest	0	0	0	0
Willow Canyon	0	0	0	0
<b>Table 11-24. Vulnerability Assessment for Problem Soils, Unincorporated Salt Lake County</b> (2006 socioeconomic projections)				

## Hazards and Future Development

Population Estimates									
County	2000 Pop (July 1)	2006 Pop (est.)	Absolute Change 2000-2006	% Change 2000-2006	AARC 2000-2006	Rank by 2000 Pop	Rank by Absolute Change	Rank by % Change	Rank by AARC
Salt Lake County	902,777	996,374	93,597	10.4%	1.7%	1	2	12	12
Population by County and Multi-County District									
MCD/ County	1980	1990	2000	2010	2020	2030	2040	2050	AARC 2000-2050
Wasatch Front	941,172	1,104,356	1,389,252	1,665,238	1,966,372	2,207,282	2,429,057	2,654,682	1.3%
Salt Lake County	625,000	728,298	902,777	1,053,258	1,230,817	1,381,519	1,521,926	1,663,994	1.2%
Households by County and Multi-County District									
MCD/ County	1980	1990	2000	2010	2020	2030	2040	2050	AARC 2000-2050
Wasatch Front	298,700	357,257	446,844	565,333	679,589	780,369	870,671	960,756	1.5%
Salt Lake County	201,742	240,367	297,064	362,825	429,889	493,268	551,047	608,614	1.5%
<b>Table 11-25. Demographic and Economic Projections (UPEC 2007, 2008)</b> All statistics are based on July 1 snapshot.									

Salt Lake County development trends have recently slowed with many new developments stalled. Development that is still occurring will be in the southern and western portions of the County because housing and land values are slightly lower. Development is tending to occur on agricultural lands. The Wasatch Mountain Range and the Great Salt Lake restrain development in the northern and eastern reaches of Salt Lake County.

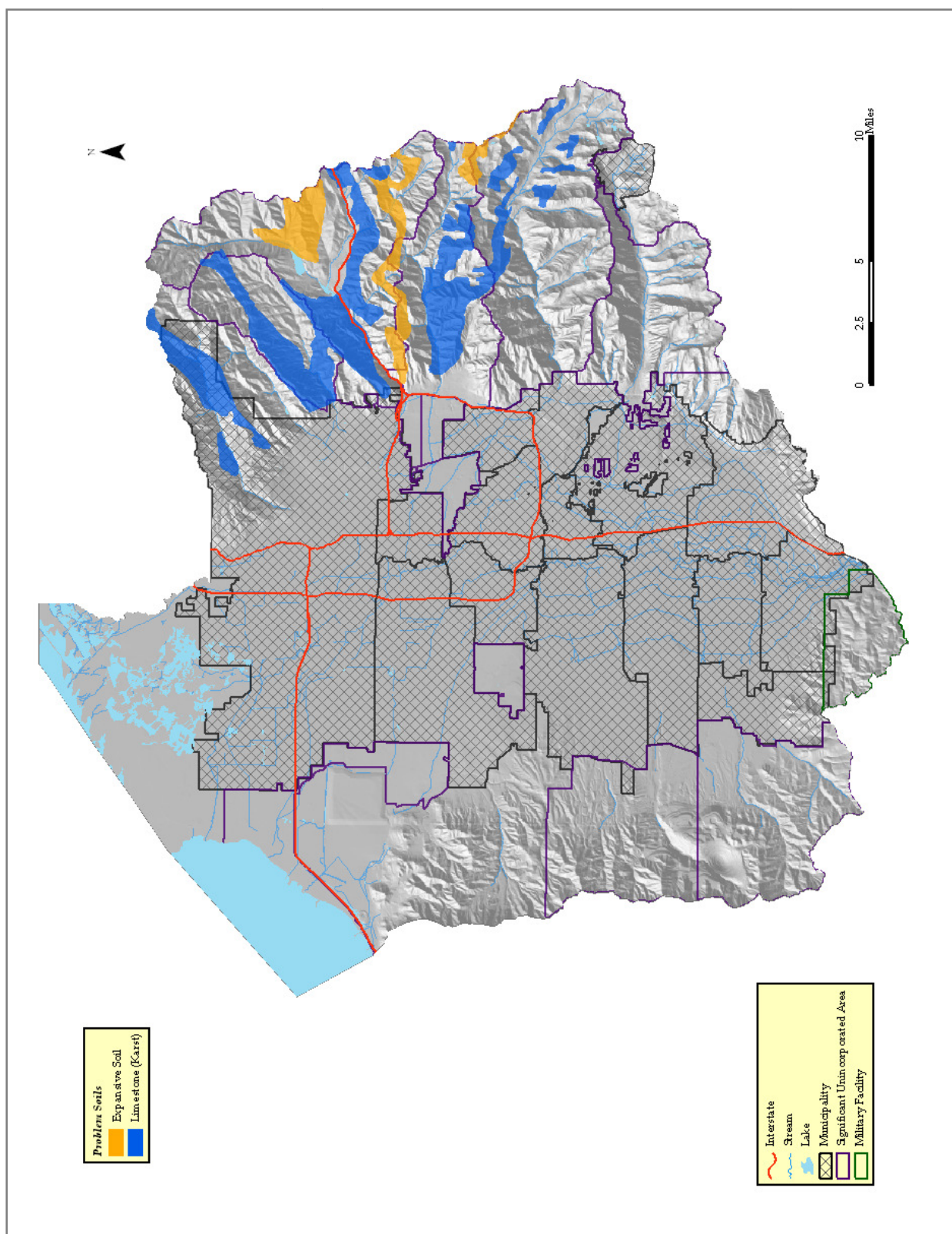
Those portions of the County near the Great Salt Lake and the Jordan River are subject to high liquefaction in the event of an earthquake and therefore pose a risk to incoming residents and new structures. Jurisdictions may mitigate the earthquake threat and its secondary risks through the use of zoning ordinances and building codes that will recognize the threat and reduce its impact. Examples of more appropriate forms of land use along fault lines include “farms, golf courses, parks, and undeveloped open space” (UGS 1996).

Flooding is also possible along the Jordan River. Many new homes have been built along the river’s banks in areas that flooded in 1983-84. Zoning restrictions on building location and building codes preventing basements would be well-suited in these areas.

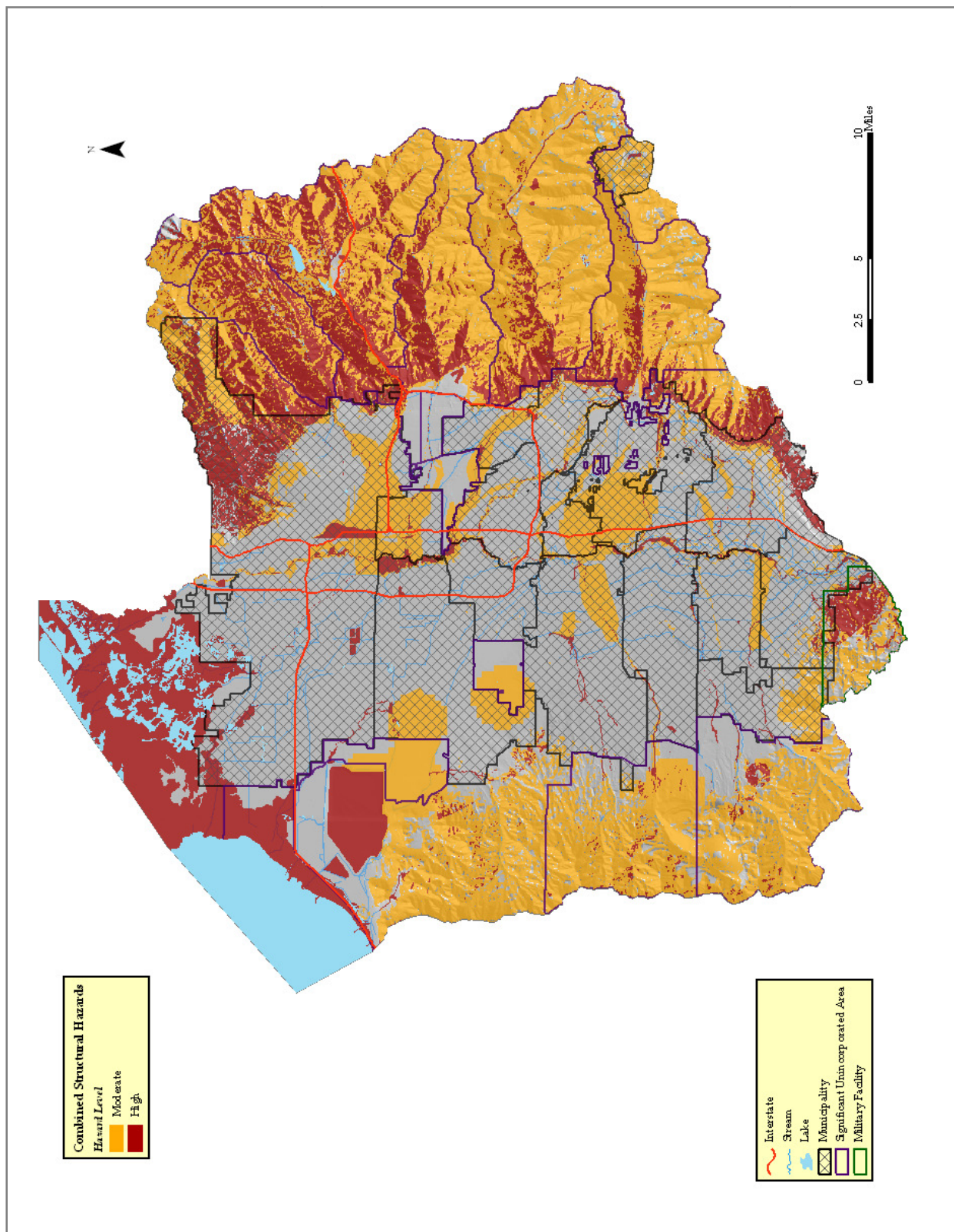
Wildfire risk is most severe in the foothills of the Wasatch Mountain Range. These areas, known as Wildland-Urban Interface (WUI) zones, are most vulnerable due to the amount and types of vegetation and new structures that act as fuel to a burning fire. This threat may be mitigated by encouraging communities to become “Fire Wise Communities”, continued use of building and zoning codes and increase the public’s awareness.

Landslide/slope failure is another threat near the foothills of the Wasatch Mountains. Many new developments can be found near areas of current landslides. More detailed landslide studies and zoning appropriate for high hazard areas will decrease the likelihood of landslides injuring persons or damaging property.

Map 11-12 (page 222) shows the combined risk of nine structurally-threatening hazards (dam failure, earthquake, flood, landslide, lightning, problem soils, tornado, wildland fire and wind) in Salt Lake County. The areas of high hazard (red) are areas of high landslide and flood risk as well as the “extreme” risk wildland fire areas. These areas are best preserved as open space to protect citizens from almost certain disasters. The moderate areas of the map (orange) are those areas having moderate or greater risk from five (5) or more structurally-threatening hazards. These areas should be preserved as open space if not already developed or hazard-appropriate development encouraged. If already developed, these areas should be the initial focus of education campaigns and for regulatory requirements of hazard mitigation techniques by residents.



**Map 11-11. Problem Soils Hazard Map, Salt Lake County (Mulvey 1992)**



**Map 11-12. Combined Hazards to Structures, Salt Lake County**

## Mitigation Strategies

The following mitigation strategies were formulated by the Salt Lake County Mitigation Strategies Working Group on November 20, 2007, at Holladay City Hall. The Working Group sought to refine and expand on efforts already in place. Additional information was provided in October, 2008 by the Central Utah Water Conservancy District in regards to the Red Butte Dam in Salt Lake County that was developed through the course of an ongoing Hazard Mitigation Planning effort, which began in July, 2007 and is scheduled to be completed in February, 2009. Information on Working Group members can be found in Part IV. "Emergency Services" for the purpose of this section is defined as County and City emergency management and may include relevant emergency response agencies.

### All Hazards

**Problem Identification:** One of the pivotal aspects of disaster response is communication. Without effective communication, relief and rescue operations become chaotic and disorganized, as evidenced by the 2005 Hurricane Katrina event. During that event, communication systems often were inoperable, incompatible or merely went unused because of lack of training (Peterson 2005).

**Goal 1 – Improve and maintain communications capabilities for emergency operations**

**Objective 1.1 (Priority HIGH): Improve communications capabilities**

**Action 1:** Conduct an inventory and assessment of communications equipment and systems and identify needs.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services

Jurisdictions: Countywide

**Action 2:** Conduct training and awareness activities on communications equipments, tools, and systems.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services

Jurisdictions: Countywide

**Action 3:** Establish agreements to share communications equipment between agencies involved in emergency operations.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services

Jurisdictions: Countywide

Action 4: Establish notification capabilities and procedures for emergency personnel.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services

Jurisdictions: Countywide

Objective 1.2 (Priority HIGH): Maintain communications capabilities for critical facilities

Action 1: Evaluate vulnerability of critical communications systems.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services

Jurisdictions: Countywide

Action 2: Establish redundancy for dispatch centers and other critical communications systems.

Time Frame: 1-2 years

Funding: State, Federal

Estimated Cost: Unknown

Staff: Emergency Services

Jurisdictions: Countywide

Objective 1.3 (Priority HIGH): Conduct Communications Strategic Planning

Action 1: Establish a coordinating group to address long-term communication needs and implementation strategies.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services

Jurisdictions: Countywide

Action 2: Acquire, upgrade, and/or integrate communications equipment and systems as determined by coordinating group.

Time Frame: 1-2 years

Funding: Federal Grants

Estimated Cost: \$3,000,000.00

Staff: Emergency Services

Jurisdictions: Countywide

Problem Identification: Without sufficient knowledge of hazards affecting a jurisdiction, effective and efficient mitigating actions cannot be properly applied. Information on critical and high value infrastructure is also important. Advances in mapping technology and observational techniques have given a significantly clearer vision of hazards and vulnerability. This technology is only effective if utilized with up-to-date data.

## Goal 2 – Improve awareness and analysis of hazards

### Objective 2.1 (Priority MEDIUM): Improved quality and access to digital geographic (GIS) hazards data

- Action 1: Establish a coordinating group to address geographic data issues.  
Time Frame: 1-2 years  
Funding: State, Local  
Estimated Cost: Minimal  
Staff: Emergency Services, County/City GIS, AGRC, UGS, DNR and Federal Forest Service  
Jurisdictions: Countywide
- Action 2: Examine current data availability and sharing capabilities, evaluate needs, and identify shortcomings.  
Time Frame: 1-2 years  
Funding: State, Local  
Estimated Cost: Minimal  
Staff: Emergency Services, coordinating group  
Jurisdictions: Countywide
- Action 3: Update and expand data on hazards, critical facilities, and critical infrastructure according to assessed needs.  
Time Frame: 3-5 years  
Funding: State, Local  
Estimated Cost: Minimal  
Staff: Emergency Services, County/City GIS, Special Service Districts, State & Federal agencies  
Jurisdictions: Countywide
- Action 4: Provide centralized access to geographic data to emergency planners and responders.  
Time Frame: Ongoing  
Funding: Local  
Estimated Cost: Minimal  
Staff: Emergency Services, County/City GIS, Special Service Districts GIS  
Jurisdictions: Countywide

### Objective 2.2 (Priority MEDIUM): Improve and expand hazard monitoring capabilities.

- Action 1: Integrate existing hazard monitoring networks in emergency operations centers. Utilize sensors such as weather stations, stream gauges, seismograph stations, road conditions, etc.  
Time Frame: 1-2 years  
Funding: State, Local  
Estimated Cost: Minimal  
Staff: Emergency Services, various special service districts, state and federal monitoring entities  
Jurisdictions: Countywide

Action 2: Identify and implement additional hazard monitoring capabilities.

Time Frame: 3-5 years

Funding: State, Local

Estimated Cost: Minimal

Staff: Emergency Services, various special service districts, state and federal monitoring entities

Jurisdictions: Countywide

Problem Identification: Certain infrastructure must be able to withstand the most extreme hazard event expected in order to provide coordinated response operations, shelter, and evacuation, if necessary. Some examples of critical infrastructure include police stations, fire stations, schools, water systems, emergency operations centers and major transportation routes.

Goal 3 – Ensure critical facilities can sustain operations for emergency response and recovery

Objective 3.1 (Priority HIGH): Prevent damage to critical facilities and infrastructure.

Action 1: Utilize GIS to identify facilities and infrastructure at risk.

Time Frame: 1-2 years

Funding: State, Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City/Special Service District GIS

Jurisdictions: Countywide

Action 2: Assess critical facilities for hazard exposure, structural weaknesses, power, communications and equipment resources and redundancy, and adequate emergency procedures.

Time Frame: 2-3 years

Funding: State, Local

Estimated Cost: Minimal

Staff: Emergency Services, Public Works

Jurisdictions: Countywide

Action 3: Implement Improvements to address needs identified in assessment.

Time Frame: 3-5 years

Funding: State, Local

Estimated Cost:\$1,000,000 Include possible structural improvements and equipment purchases

Staff: Emergency Services, County/City/Special Service District GIS

Jurisdictions: Countywide

Problem Identification: Hazardous events often overcome the resources of any one jurisdiction. An effective measure which ensures adequate response to a hazardous event is mutual-aid agreements specifying resources and assistance from adjoining jurisdictions or state and federal agencies.

Goal 4 – Improve response capabilities through mutual-aid agreements

Objective 4.1 (Priority MEDIUM): Utilize mutual-aid agreements in accordance with National Incident Management System (NIMS) requirements.

Action 1: Compile inventory of current mutual-aid agreements and memoranda of understanding (MOU) and identify deficiencies.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City/Special Service District Attorney

Jurisdictions: Countywide

Action 2: Pursue and implement needed mutual-aid agreements.

Time Frame: 3-5 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City/Special Service District Attorney

Jurisdictions: Countywide

Problem Identification: One of the most cost-effective means of mitigating hazards is through public education. This allows citizens to make informed choices to themselves mitigate hazards affecting them. Education can be especially effective when tied to grant programs.

Goal 5 – Increase citizen safety through improved hazard awareness

Objective 5.1 (Priority HIGH): Establish a comprehensive public education program.

Action 1: Provide education regarding all natural hazards through live trainings, as well as web-based, print and broadcast media.

Time Frame: Ongoing

Funding: Local

Estimated Cost: Unknown

Staff: Emergency Services, County/City Fire/Police, Special Service District, Building Code Enforcement.

Jurisdictions: Countywide

Action 2: Incorporate information about cascading effects of hazards in education programs.

Time Frame: Ongoing

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City Fire/Police, Special Service District, Building Code Enforcement.

Jurisdictions: Countywide

Action 3: Develop education programs to target specific groups including homeowners, developers, schools and people with special needs.

Time Frame: Ongoing

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City Fire/Police, Special Service District, Building Code Enforcement

Jurisdictions: Countywide

Action 4: Utilize maps and similar products on County EM website and other media to educate public on areas at risk to hazards.

Time Frame: Ongoing

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City/ Special Service District GIS

Jurisdictions: Countywide

Action 5: Coordinate with existing public education programs such as the American Red Cross, Utah Living with Fire, Be Ready Utah, the National Weather Service, etc.

Time Frame: Ongoing

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, various public education programs

Jurisdictions: Countywide

Problem Identification: Sometimes hazards require mandated mitigation in the form of ordinances, codes, laws or regulations. Zoning ordinances and building codes are the most common form of mitigation.

Goal 6 – Improve public safety through preventative regulations

Objective 6.1 (Priority HIGH): Minimize hazard impacts through the adoption of appropriate prevention measures.

Action 1: Establish and enforce appropriate planning, zoning, and building code ordinances.

Time Frame: 3-5 years

Funding: Local

Estimated Cost: Unknown

Staff: Emergency Services, County/City Councils, Building Code Enforcement, Planning/Engineering Departments

Jurisdictions: Countywide

Action 2: Ensure current hazard ordinances are available for viewing online.

Time Frame: 3-5 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City Councils, Building Code Enforcement, Planning/Engineering Departments

Jurisdictions: Countywide

## **Dam Failure**

Problem Identification: The failure of dams and irrigation impoundments will result in a severe impact on residents and infrastructure in Salt Lake County.

Goal 1 – Include dam failure inundation in future planning efforts.

Objective 1.1 (Priority MEDIUM): Review current State dam safety information on all identified high hazard dams in the County.

Action 1: Include dam inundation maps in current County, City and Special Service District Emergency Operations Plans.

Time Frame: 3-5 Years

Funding: Undetermined

Estimated Cost: \$10,000

Staff: Emergency Services

Jurisdictions: Countywide

Action 2: Utilize inundation maps to identify potential evacuation areas and routes.

Time Frame: 3-5 Years

Funding: Undetermined

Estimated Cost: Unknown

Staff: Emergency Services

Jurisdictions: Countywide

## **Drought**

Problem Identification: Because the Great Salt Lake Valley is a desert climate, there have always been periods of intermittent drought. Measures must be taken to conserve water and to address water shortages for both culinary and agricultural use.

Goal 1 – Reduce and prevent hardships associated with water shortages

Objective 1.1 (Priority HIGH): Limit unnecessary consumption of water throughout the County

Action 1: Continue to encourage water conservation utilizing and promoting outreach material from all water districts in the County.

Time Frame: Ongoing

Funding: Minimal

Estimated Cost: Undetermined

Staff: Public Works in coordination with water districts.

Jurisdictions: Countywide

Action 2: Emergency Managers will coordinate with local water districts/public utilities to support ongoing conservation efforts.

Time Frame: Ongoing

Funding: Minimal

Estimated Cost: Undetermined

Staff: Should coordinate with local water districts.

Jurisdictions: Countywide

Action 3: Investigate feasibility of implementing an incentive program to encourage the use of low-flow appliances and fixtures in homes and businesses.

Time Frame: 3-5 years

Funding: Unknown

Estimated Cost: Undetermined

Staff: Emergency Services, Water Conservation Districts

Jurisdictions: Countywide

Action 4: Implement water-saving devices and practices in public facilities.

Time Frame: 3-5 years

Funding: Local

Estimated Cost: Undetermined

Staff: Emergency Services, Public Works

Jurisdictions: Countywide

Action 5: Repair, maintain and improve water distribution infrastructure to prevent loss from leakage, breaks, etc.

Time Frame: Ongoing

Funding: Local

Estimated Cost: Undetermined

Staff: Public Works

Jurisdictions: Countywide

Action 6: Coordinate public safety water use, such as hydrant testing.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services

Jurisdictions: Countywide

Action 7: Provide information on landscaping alternatives for persons subject to green area requirements.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, Water Conservation Districts

Jurisdictions: Countywide

Objective 1.2 (Priority HIGH): Address agricultural water shortages in the County

Action 1: Set up livestock water rotation in areas of agricultural use.

Time frame: Ongoing

Funding: Minimal

Estimated Cost: Undetermined

Staff: Emergency Services, USDA, UDAF

Jurisdictions: County agricultural communities

Objective 1.3 (Priority MEDIUM): Encourage development of secondary water systems

Action 1: Coordinate with water districts to plan for, develop and/or expand secondary water systems.

Time Frame: 3-5 years

Funding: Unknown

Estimated Cost: Undetermined

Staff: Emergency Services, Water Conservation Districts, Public Works

Jurisdictions: Countywide

## Earthquake

Problem Identification: Numerous geologic hazards exist in the Salt Lake City metropolitan area which can constrain land use. Active fault zones pose the threat of large earthquakes. The major earthquake risk present throughout the Salt Lake County metropolitan area confronts planners with a variety of safety and economic issues that must always be considered prior to land use development.

Goal 1 – Reduce earthquakes losses to infrastructure

Objective 1.1 (Priority HIGH): Encourage retrofit and rehabilitation of highly susceptible infrastructure

Action 1: Identify structures at risk to earthquake damage.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Unknown

Staff: Emergency Services

Jurisdictions: Countywide

Action 2: Research feasibility of an incentive program for retrofitting privately-owned buildings, particularly unreinforced masonry.

Time Frame: 1-2 years

Funding: State, Federal

Estimated Cost: Unknown

Staff: Emergency Services

Jurisdictions: Countywide

Action 3: Complete seismic rehabilitation/retrofitting projects of public buildings at risk.

Time Frame: 1-2 years

Funding: State, Federal

Estimated Cost: Unknown

Staff: Emergency Services

Jurisdictions: Countywide

Objective 1.2 (Priority MEDIUM): Improve public education regarding earthquake risks to unreinforced masonry buildings

Action 1: Provide educational materials to unreinforced masonry home and business owners.

Time Frame: Ongoing

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services

Jurisdictions: Countywide

Objective 1.3 (Priority MEDIUM): Improve seismic hazard understanding and seismic resistance of Central Utah Water Conservancy District's (CUWCD) Red Butte Dam in Salt Lake County. Perform geotechnical assessment and review of Red Butte Dam to determine seismic hazard risk of slope failure on the outlet control structure and cyclic softening failure in the dam foundation soils. Perform a structural engineering analysis and design of nonstructural bracing/anchoring of piping and ancillary equipment in Red Butte Dam's flow control structure." Improve public education regarding earthquake risks to unreinforced masonry buildings

Action 1: Procure an Engineering Consultant to perform the nonstructural design and geotechnical assessment and review. CUWCD staff will procure contractor and/or install nonstructural bracing per consultant's design.

Time Frame: 1-3 years

Funding: FEMA PDM Grant and CUWCD funds

Estimated Cost: \$75,000

Staff: CUCWD staff, engineering consultant contractor

Jurisdictions: Central Utah Water Conservancy District (CUWCD)

## **Flooding**

Problem Identification: Although located in a semi-arid region, Salt Lake City is subject to flash flooding due to heavy rainfall and rapid snowmelt. The Jordan River's four major northern tributaries (City, Red Butte, Emigration and Parley's Creeks) are diverted into storm sewers beneath the city. These storm sewers have sufficient capacity to handle the excessive runoff, but must be continually maintained to prevent debris from accumulating. Public works agencies have built debris basins, installed stream-bank protection, and regularly dredge stream channels to reduce flood hazards. The Federal Emergency Management Agency (FEMA) has rated floodplains along the Jordan River and its tributaries for expected flood heights and areas susceptible to 100-year flood-frequency inundation have been delineated on County-wide FEMA Flood Insurance Rate Maps (FIRMs). Salt Lake County ordinances require the lowest flood grades (including basements) in new construction to be a minimum of 1 foot (0.3 m) above the appropriate FEMA flood elevation.

Goal 1 – Protection of life and property before, during and after a flooding event

Objective 1.1 (Priority MEDIUM): Provide 100% availability of the National Flood Insurance Program (NFIP).

Action # 1: Assist cities with NFIP application.

Time Frame: 1 year

Funding: Local

Estimated Cost: Minimal

Staff: City Managers, County Emergency Services, State Floodplain Manager

Jurisdictions: Countywide

Action # 2: Encourage communities to actively participate in NFIP.

Time Frame: 1 year

Funding: Local

Estimated Cost: Minimal

Staff: City Managers, County Emergency Services, FEMA, NWS

Jurisdictions: Countywide

Objective 1.2 (Priority MEDIUM): Encourage appropriate flood control measures, particularly in new developments.

Action 1: Determine potential flood impacts and identify areas in need of additional flood control structures.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: City Managers, County Emergency Services, State Floodplain Manager, Public Works, USACE

Jurisdictions: Countywide

Action 2: Address identified problems through construction of debris basins, flood retention ponds, energy dissipaters or other flood control structures.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: City Managers, County Emergency Services, State Floodplain Manager, Public Works, USACE

Jurisdictions: Countywide

Objective 1.3 (Priority HIGH): Provide maintenance, repairs and improvements to drainage structures, storm water systems and flood control structures.

Action: Establish maintenance and repair programs to remove debris, improve resistance and otherwise maintain effectiveness of storm water and flood control systems.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: City Managers, County Emergency Services, Public Works

Jurisdictions: Countywide

Goal 2 – Reduce threat of unstable or inadequate flood control structures

Objective 2.1 (Priority HIGH): Reduce potential for failure of flood control structures.

Action 1: Identify and assess structures for deficiencies.

Time Frame: 1-2 years

Funding: Local

Estimated Cost: Minimal

Staff: City Managers, County Emergency Services, Public Works

Jurisdictions: Countywide

Action 2: Modify structures as needed to address deficiencies.  
Time Frame: 2-3 years  
Funding: Local, grants  
Estimated Cost: Retrofit structural modifications are very expensive  
Staff: City Managers, County Emergency Services, Public Works  
Jurisdictions: Countywide

## **Severe Weather**

Problem Identification: Severe weather over northern Utah can have a dramatic impact on regional commerce, transportation and daily activity and is a major forecast challenge for local meteorologists. The region is characterized by intense vertical relief with the Great Salt Lake and surrounding lowlands located near 4,300 ft above mean sea level (MSL) while the adjoining Wasatch Mountains to the east reach as high as 11,000 ft MSL. This relief has major impact on winter storms and results in large contrasts in average annual precipitation.

Goal 1: Reduce threat of loss of life or property due to extreme weather events

Objective 1.1 (Priority LOW): Maintain status as a StormReady Community

Action 1: Maintain Hazardous Weather Operations Plan according to StormReady requirements.  
Time Frame: 1-2 years  
Funding: Local  
Estimated Cost: Unknown  
Staff: Emergency Services, NOAA National Weather Service (NWS)  
Jurisdictions: Countywide

Action 2: Maintain contact with NWS prior to re-application in 2010.  
Time Frame: 2 years  
Funding: None  
Estimated Cost: None  
Staff: Emergency Services, NWS  
Jurisdictions: Countywide

Objective 1.2 (Priority MEDIUM): Increase awareness of information services provided by NWS.

Action 1: Meet with NWS representative on an annual basis to receive information on new services and alerts available.  
Time Frame: Annually  
Funding: Local  
Estimated Cost: Minimal  
Staff: Emergency Services, NWS  
Jurisdictions: Countywide

Action 2: Assist NWS in making other agencies and departments aware of available resources.

Time Frame: Annually

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, NWS

Jurisdictions: Countywide

Objective 1.3 (Priority MEDIUM): Encourage safe practices in avalanche prone areas.

Action: Assist Forest Service Utah Avalanche Forecast Center (FSUAC) and other organizations in promoting avalanche hazard awareness for backcountry users.

Time Frame: Annually

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, FSUAC, mountain resorts

Jurisdictions: Countywide

Objective 1.4 (Priority HIGH): Examine the vulnerability of patrons at large event venues to extreme weather events.

Action: Work with the NWS to develop large event venue weather safety and evacuation procedures.

Time Frame: 3-5 years

Funding: State, Federal

Estimated Cost: Unknown

Staff: Emergency Services, Utah Division of Homeland Security, National Weather Service

Jurisdictions: Countywide

## **Slope Failure**

Problem Identification: Slope instability has not been a major problem in the Salt Lake area. Yet, as development moves higher into the foothills and nearby canyons, slope stability is becoming a major issue affecting future development. Types of slope instability in the Salt Lake area include rock fall, debris flow and debris flood, rotational and transitional slumps, and earth flows. During the unusually wet springs of 1983 and 1984, numerous slope failures in the Wasatch Range resulted in debris flows and floods that caused extensive damage to urban areas north of Salt Lake City (Anderson and others, 1984). Similar failures occurred in canyons adjacent to Salt Lake City, but none reached developed areas.

In Salt Lake County, 56 percent of all slope failures have occurred on hillsides where slopes range between 31 and 60 percent. That statistic prompted Salt Lake County in 1986 to lower the maximum allowable buildable slope from 40 percent to 30 percent. Even so, 23 percent of observed slope failures have occurred on slopes of 30 percent or less.

Goal 1 – Reduce or eliminate the threat of slope failure damage

Objective 1.1 (Priority MEDIUM): Reduce the threat of slope failures following wild fires.

Action 1: Develop protocol for working with State and Federal agencies in reducing the impact of post-fire debris flow hazard.

Time Frame: 3-5 years

Funding: Federal Grants

Estimated Cost: Unknown

Staff: Emergency Services, National Weather Service, National Resource Conservation Service, United States Forest Service, and the Utah Geological Survey (UGS)

Jurisdictions: County communities on Alluvial Fans

Objective 1.2 (Priority MEDIUM): Monitor historic landslide areas.

Action 1: Coordinate with Utah Geological Survey and other agencies to understand current slope failure threats/potential.

Time Frame: 1-2 years

Funding: State and Federal Grants

Estimated Cost: Unknown

Staff: Emergency Services, UGS, United States Geological Survey

Jurisdictions: County communities on Alluvial Fans

Objective 2.1 (Priority HIGH): Address landslide hazards in new sub-divisions.

Action 1: Utilize recommendations provided by State Geologic Hazards Working Group to address land-use and planning for new developments.

Time Frame: 3-5 years

Funding: Local and Federal Grants

Estimated Cost: Minimal

Staff: Emergency Services, Planning Department, UGS

Jurisdictions: County communities on Alluvial Fans

## Wildland Fire

Problem Identification: Utah's typical fire season is the dry period from May through October. Lightning causes the largest numbers of wildfires.

Recent large western states wildfires; the 1991 Oakland Hills fires, 1994 Tyee fire in Washington, the 1993 and 2007 Southern California fire sieges are examples of the growing fire threat which occurs in the Wildland/Urban Interface (WUI). The WUI is defined as the area where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Since 1985, approximately 9,000 homes have been lost to urban/wildland interface fires across the United States.

In 1990, Salt Lake County created a wildland program shortly after a wildland fire threatened Emigration Canyon, a major urban interface area at the county's eastern boundaries. The fire began in the Affleck Park day use picnic area, possibly the result of an unattended campfire. The fire quickly spread to the west and up the side of the mountain, with only one ridge between it and Emigration Canyon. The incident lasted for five days, in which time 5,500 acres were burned. Fortunately, no one was injured and no structures were lost.

### Goal 1 – Community education on wildfire hazard

Objective 1.1 (Priority HIGH): Reduce risk from wild fire through education programs

Action 1: Increase public awareness through "Fire Wise" program.

Time frame: Ongoing

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City Fire, FFSL, State Fire Marshall

Jurisdictions: Identified WUI communities

Action 2: Educate homeowners on the need to create defensible space near structures in WUI.

Time frame: Ongoing

Funding: Local

Estimated Cost: Minimal

Staff: Emergency Services, County/City Fire, FFSL, State Fire Marshall

Jurisdictions: Identified WUI communities

Goal 2 – Improve safety from wildfire hazards through planning, protective actions and improved fire response capabilities

Objective 2.1 (Priority HIGH): Assist homeowners with creating defensible space near structures in WUI areas.

Action 1: Designate and promote county-wide annual initiative for clearing fuels.

Time frame: Ongoing

Funding: Local

Estimated Cost: Unknown

Staff: Emergency Services, County/City Fire, Public Works

Jurisdiction: Identified WUI communities

Action 2: Provide waste removal, such as chipping of green waste by Public Works, following designated fuel clearing day/week.

Time frame: Ongoing  
Funding: Local  
Estimated Cost: Unknown  
Staff: Emergency Services, Public Works  
Jurisdictions: Identified WUI communities

Objective 2.2 (Priority HIGH): Improve evacuation capabilities for WUI areas.

Action 1: Work with experts and communities to develop or update evacuation plans.

Time frame: Ongoing  
Funding: Local  
Estimated Cost: Minimal  
Staff: Emergency Services, Planning Departments  
Jurisdictions: Identified WUI communities

Action 2: Evaluate transportation network and address needed improvements to facilitate evacuation and emergency response.

Time frame: Ongoing  
Funding: Local  
Estimated Cost: Unknown  
Staff: Emergency Services, Planning Departments  
Jurisdictions: Identified WUI communities

Objective 2.3 (Priority HIGH): Improve addressing system in WUI areas to facilitate emergency response.

Action 1: Identify all facilities, businesses, and residences, particularly in the canyons, and assign addresses according to current county addressing standards.

Time frame: Ongoing  
Funding: Local  
Estimated Cost: Unknown  
Staff: Emergency Services, city and county recorders  
Jurisdictions: Countywide

Action 2: Incorporate improved addresses in fire-dispatch and other databases.

Time frame: Ongoing  
Funding: Local  
Estimated Cost: Unknown  
Staff: Emergency Services, County/City Fire  
Jurisdictions: Countywide

Objective 2.4 (Priority HIGH): Complete wildfire protection projects

Action 1: Reduce fuels around publicly owned structures.

Time frame: Ongoing  
Funding: Local, grants  
Estimated Cost: Unknown  
Staff: Emergency Services, Public Works  
Jurisdictions: Identified WUI communities

- Action 2: Implement fire breaks and other protective measures.  
Time frame: Ongoing  
Funding: Local, grants  
Estimated Cost: Unknown  
Staff: Emergency Services, Public Works, state and federal agencies  
Jurisdictions: Identified WUI communities
- Action 3: Assess existing water flow capabilities, both public and private, and address deficiencies.  
Time frame: Ongoing  
Funding: Local  
Estimated Cost: Unknown  
Staff: Emergency Services, County/City Fire  
Jurisdictions: Identified WUI communities
- Action 4: Assist communities in developing Community Wildfire Protection Plans or similar plans.  
Time frame: Ongoing  
Funding: State and Federal Grants  
Estimated Cost: Unknown  
Staff: Emergency Services  
Jurisdictions: Countywide

Objective 2.5 (Priority HIGH): Encourage proper development practices in the WUI.

- Action 1: Adopt the Utah Wildland-Urban Interface Code (Code addresses proper road accessibility, availability of water flow for fire response, etc.)  
Time frame: Ongoing  
Funding: Local  
Estimated Cost: Unknown  
Staff: Emergency Services, City and County Councils  
Jurisdictions: Countywide
- Action 2: Define wildland-urban interface and develop digital maps of the WUI.  
Time frame: Ongoing  
Funding: Local  
Estimated Cost: Unknown  
Staff: Emergency Services, AGRC  
Jurisdictions: Countywide